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WVT-11-6412

AUGUST 1964

BORE EVACUATOR VALVE TEST, CANNON 155MM HOWITZER, M126

TECHNICAL REPORT

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OMS CODE NO. 4020.24.2223.2.10.04

WVT-11-6412

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BORE EVACUATOR VALVE TEST, CANNON 155mm HOWITZER, M126

ABSTRACT

The limited life of Bore Evacuator Valve Assembly 8769384 during firing tests led to the authorization of a test program to find a valve assembly with a longer life. The cost of testing in the gun (155mm How. M126) made it economical to build a test apparatus which simulated the weapon. The test program was the basis for the incorporation of valve assembly 8769531 into the weapon system. A comparison of the strain level of the modification is presented. The life of the then current production valve assembly and the new production valve assembly under different charges is also given.

Cross-Reference Data

Artillery
Howitzers
Cannon, 155mm T255E3
Cannon, 155MM How M126
Bore Evacuation Valves
Bore Scavenging

CONCLUSIONS AND RECOMMENDATIONS

Instrumented firing resulted in the choice of new valve assembly 8769531 as the assembly to be fatigue tested against the current production valve assembly 8769384. The former combination of components had the lowest strain level of all the assemblies tested.

During the fatigue test on valve assemblies 8769531 and 8769384 each had an average life of 6890 and 400 rounds, respectively, before crack initiation.

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INTRODUCTION

During test firing of Cannon, 155mm Howitzer, M126, it was found that the life expectancy of the bore evacuator valve assemblies could be markedly increased. A design change was authorized as a product improvement measure. To obtain correlation with calculated stress data, limited tests were made on valves fitted with strain gages and fired in the cannon.

Since it was planned to test several design modifications, and the cost to fire the valves in the cannon was expected to be high, equipment was designed which would simulate conditions of pressure and stress of the valve body while using the facilities available at Watervliet Arsenal.

OBJECTIVE

The object of this program was to test several valve modifications of bore evacuator valve design for Cannon, 155mm How., M126. The valve modification with the lowest stress level was to be test fired along with valve assembly 8769384 to determine relative life expectancy.

MATERIAL AND APPARATUS

A 30 caliber M1903 Springfield bolt action rifle, firing grenade launcher ammunition, was used as the pressure generator for the test. An adapter (Figure 5) was made to secure the valve assembly in line with the muzzle end of the barrel, which allowed the charge to be fired directly into the valve. Another adapter (Figure 6) was made to give end pressure readings from the first adapter. The weapon was mounted in a specially built sta... shown in Figures 1 and 2.

Figure 2 is a cross section drawing of the valve and adapter installed on the end of the rifle barrel. The length of the barrel was modified to obtain pressures similar to those the valve would experience when installed in the cannon.

Two oscilloscopes shown on Figure 3a were used to record the data, a Tektronix Type 535 scope with a 53-54C dual trace plug-in unit recorded pressures in conjunction with a Kistler Pressure Pickup Unit and a Tektronix Type 502 scope which took the strain readings. Figure 3b shows a closeup of the strain gage junction box, the compensating gages and a strain gaged valve body. A schematic wiring diagram, for both pressure and strain gage circuits, is shown in Figure 4.

The eleven valve assemblies compared with the current production valve assembly were made by combining the different modifications proposed. There were four different valves used in the assemblies. Figure 7 shows Valve 8769383, which was the then current production valve. The first modified Valve RDI-B7214, is shown in Figure 8. It was made by drilling a 3/8" diameter by 1/2" deep hole in the center of the top of the valve. Modification two, Valve RDI-B7215, shown in Figure 9, extended this hole to a depth of 5/8" and the third valve modification, Valve 8769529 (Figure 10), continued this hole to a depth of 1.8 inches. The then current production valve body, Body (Valve) 8769382, is shown in Figure 11. Body (Valve) RDI-B7212, Figure 12, was made by shortening Body (Valve) 8769382 by .272 inches. The other modified valve body, Body (Valve) 8769530, Figure 13, replaced the multiple holes with two long slots. Figure 14 shows Cap 8769381 used with valve bodies 8769382

and 8769530. Cap RDI-B7213, Figure 15, was used with Body (Valve) RDI-B7212.

The twelve valve assemblies are shown in Figures 16 - 27. Figures 16 - 19 are of Body (Valve) 8769382 with its Cap 8769381, and the four valves 8769381, RDI-B7214, RDI-7215 and 8769529 in this order. Figures 20, 21, 22 and 23 show Body (Valve) RDI-B7212 and its Cap RDI-B7213 with the various valves in the order above. Finally, Figures 24-27 show Body (Valve) 8769530 and Cap 8769381 with the four valves as listed above.

PROCEDURE

The 30 caliber Springfield rifle was modified to accomodate the bore evacuator valve adapter on its barrel. It was found necessary to insert an orifice in the adapter to raise the pressure and completely burn the propellant. As maximum pressure obtainable with the full barrel was too low, the length of the barrel was reduced. This raised pressure level permitted changes to the orifice size for the desired pressure, and/or strain.

With each change in orifice size, a series of rounds was fired using a valve assembly of the type shown in Figure 16, which had been fitted with strain gages and the strains were recorded. The strain gages were located on the valve body in the same position as those on the valve body which had been fired several rounds in a Cannon, 155mm Howitzer, M126 at Erie Proving Ground (see Figure 28). It was decided to change the orifice size until strains in the valve body on the test rig approached as nearly as possible the strains recorded from the valve assembly fired at the proving ground. The data from the proving ground is contained in the

memo dated 18 September 1963 titled "Firing Test to Determine Strains in the 155mm Howitzer T255E3, Bore Evacuator Valve During Firing", which is included in Appendix I.

After the optimum orifice size was determined, each of the modified assemblies was tested and the strain levels were compared with those recorded on Valve Assembly 8769384, Figure 16. Figure 29 shows the location of the strain gages on the short valve body, Body (Valve) RDI-B7212. The strain gage locations for the slotted valve body, Figure 13, are shown in Figure 30. Observation of the stress pattern on a valve body, shown in Figure 32, to which "Stress Coat", manufactured by the Magnaflux Corp., had been applied, led to the relocation of four strain gages on Body (Valve) 8769382. This can be seen by comparing Figures 28 and 31. The results of the test firing are given in Table I. Table II shows the "Reduction in Strain with Various Modifications." Valve Assembly 8769531, Figure 21, had the lowest strain readings and was chosen for use in the life test.

Seven (7) valve assemblies were used in the fatigue test. Four (4) were valve assembly 8769384. These were designated standard valves 1 through 4 or S.V. 1, etc. Three (3) valve assemblies 8769531 were designated modified valves 1 through 3, abbreviated M.V. 1, etc. Table 4 shows the average life obtained for the valve assemblies fired in the test program and in the cannon with different propellant charges. Table 3 gives the life of each of the valves fired in the Watervliet Arsenal test program.

During the life test, the valve assemblies were subjected to magnetic

particle inspection every 50 rounds. Figures 33 and 34 are standard valve 1 after 1000 rounds and modified valve 3 after 10,000 rounds, respectively. These pictures are taken under the conditions of magnetic particle inspection and the crack indications in the thread runout are shown by the arrows. Both valve assemblies were macroetched with a 50 per cent HCL solution for 30 to 45 minutes. Figure 35 shows 3 photos of modified valve 3. Figure 36 shows standard valve 1 and a Body (Valve) 8769530 cut and etched as above, after 1000 rounds of 100-115 per cent RMP at Erie Proving Ground.

Due to the long life experienced, an attempt was made to shorten this life by means of a cold test. It was felt that if the temperature of the valve body could be lowered to the vicinity of the ductile-brittle transition temperature, the fatigue life of the test pieces could be shortened. Although the cold test apparatus lowered the initial valve body temperature, the rate of fire to keep the temperature of the valve body at a low temperature was so slow that this procedure was unsatisfactory. This phase of the test was abandoned after 300 rounds, due to the problems of additional time to fire, shorter runs, and inaccessibility of the valve assembly to check the valve between rounds.

RESULTS AND DISCUSSION

The slotted valve body, Figure 13, reduced the stress concentration in the body area caused by the multiple hole configuration of the Body (Valve) 8769382, Figure 11. The more uniform stress distribution allowed the body to absorb more of the impact energy as the impact wave traveled to the fixed end; this also helped to reduce the strain at that end.

A well rounded, larger, radius in the thread runout did not reduce the strain level in this area. Therefore, the slotted body with the normal thread runout was chosen as the best possibility.

Table IV shows a comparison of the proof house life tests results with the firing data from Erie Proving Ground and Aberdeen Proving Ground. Since the proof house testing was based primarily on the strains registered on gages attached to the valve body and pressure was a secondary consideration, it seems reasonable that the increase in valve life obtained in the proof house must be reduced by a factor which allows for differences in pressures, volume of gases, and time of exposure. This is especially true as the stresses induced approach the endurance limit of the material. A slight decrease in stress would result in a substantial increase in life. The XM119E1 charge increased the initial pressure experienced by the valve to 120 per cent of the pressure generated by the 115 per cent RMP round. This great increase in pressure and consequently in stress decreases the life significantly. Another possibility, at present not fully investigated, is that one round in the 155mm M126 may result in more than one cycle of stress applied to the valve body.

ACKNOWLEDGEMENT

The authors wish to express their appreciation for the assistance given them by the Experimental Mechanics and Thermodynamics Lab of the Research Laboratories at Watervliet Arsenal in conducting the firing tests and obtaining the necessary data.

DISPOSITION FORM

(AR 340-15)

OFFICE SYMBOL OR FILE REFERENCE	SUBJECT
SWEWV-RDR;rrl	FIRING TEST TO DETERMINE STRAINS IN THE 155MM HOW. T255E3 BORE EVACUATOR VALVES DURING FIRING

TO Industrial Engineering FROM Mr. Ralph Lasselle DATE 18 Sept 63 CMT 1
Mr. Lasselle/maf/5518

1. Four valves were strain gaged at Watervliet Arsenal and taken to Erie Proving Ground for test. The valves were designated A thru D and are as follows:

Valve A (drawing number 8769384) is the valve currently in production. This valve had eight gages symetrically spaced on the cylindrical portion of the body just above the conical valve seat. All gages were orientated to measure axial strain.

Valve B was similar to valve A in both geometry and gaging.

Valve C (drawing number WTV-C9640) had the same overall dimensions as valves A and B, but had two longitudinal slots cut in the side for passage of the propellant gases rather than the fourteen holes and the radius of the relief for the mounting threads had been increased to decrease the stress concentration factor. The valve also had a poppet which weighed 3 3/8 oz. compared to the 3 3/4 oz. for the ones in valves A and B. The gaging on this valve was the same as on valves A and B plus four additional gages mounted in the thread relief. All gages were orientated to measure axial strain.

Valve D was similar to valve C except that it had a cap weighing 3 5/8 oz. compared to the cap on valves A, B and C which weighed 5 7/16 oz. The gaging on valve D was the same as on valve C.

2. The axis of the valves were at an angle of 30° to the axis of the gun tube providing only a partial seat on the side of the valve away from the gun tube. This caused a non-uniform strain in the thread relief when torqued down to the 75 ft. lbs. recommended. The strain as measured in the gages on valve C due to mounting torque were 200 μ in/in compression in the gages adjacent to the partial seat and 500 μ in/in tension in the gages opposite the previously mentioned gages (gages between the axes of the bore evacuator valve and gun tube).

3. The strain gage data consisted of damped oscillations whose frequency ranged between 600 cps and 1,000 cps. There are two separate blocks of oscillation for each firing. The first one starts with initiation of weapon recoil and is probably due to setback forces loading the valve as a cantilever. The vibrations last for about 6 to 7 milliseconds and then are overridden by larger vibrations which occur at about the time the projectile passes the valve port. These vibrations are probably set up by the poppet action. These oscillations are damped out in approximately ten cycles. The strains reported are peak to peak vibrations with the first figures for the setback initiated vibrations and the second figures for the poppet initiated vibrations.

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BORE EVACUATOR VALVE FIRING TEST
TABLE OF STRAIN GAGE READINGS

Gage Location	A (Body)	B (Body)	C (Body)	C (Seat)	D (Body)	D (Seat)
Between axes of valve and gun tube	0 - lost	0 - lost	200 - lost	lost - lost	200 - lost	
	400 - lost	400 - lost	200 - lost		300 - lost	lost - lost
	400 - lost	400 - lost	300 - lost	lost - lost	300 - lost	
	400 - 888	400 - 2000 ten 90-100% cycles at 1000 cps	300 - 960		0 - lost	lost - lost
Opposite first gage listed (adjacent to partial bore evacuator valve seat)	200 - 640	lost - lost	100 - 960	300 - 3555 twelve 90-100% cycles at 600 cps	200 - lost	
	200 - 1600	300 - 710	200 - 1000		300 - 1600 six 90-100% cycles at 600 cps	lost - lost
	lost - lost	300 - lost	100 - lost	500 - 2000 nine 90-100% cycles at 800 cps	300 - lost	
	200 - lost	500 - lost	lost - lost		0 - lost	lost - lost

Gages are spaced every 45° about valve body.

SUBJECT: FIRING TEST TO DETERMINE STRAINS IN THE 155MM HOW. T255E3 BORE EVACUATOR VALVES DURING FIRING

4. Conclusions and Recommendations:

Due to the urgency of the project there was not sufficient time to develop a strain gage technique to get a complete set of data on all the gages, nor could one valve be fired more than one round with the same gages which is necessary to obtain the effects of reducing poppet or cap weight. One strain reading in the thread relief of valve C gave a strain of 3555μ in/in which corresponds to a simple stress of 105,000 psi. All gages in the area between the axes of the valve and gun tube were lost at the time the gases opened the poppet (as can be seen in the first line of the table), and so no peak dynamic strains were obtained at this point experiencing 500μ in/in tension due to assembly torque. It should also be remembered that the measured strains are not necessarily the maximum strains in the piece because the strain gage is an averaging device being used in a stress concentration area and that there is no guarantee that the gage was placed at the point of maximum strain.

A check of the frequency associated with various modes of vibrations of the valve indicates that the strains measured which were at 600 to 1000 cps were probably due to the valve vibrating as a cantilever beam with a mass at the end even though the major excitation was an axial impulse. The longitudinal shock wave mode might have been excited, but because its natural frequency is in the order of 15kc, it could not have been picked up by the instrumentation used.

The data seems to indicate quite clearly that the strains caused by poppet action are several times larger than those caused by setback forces. If it is determined that the fatigue lives of these valves are not satisfactory, even when it is considered that for each round fired the valve experiences approximately ten major stress cycles, it is recommended that a test device be developed that will primarily simulate poppet action.

Ralph R. Lasselle

RALPH R. LASSELLE

TABLE I

BORE EVACUATOR VALVE TEST FIRING DATA WITH OPTIMUM ORIFICE .1562" IN DIAMETER

ROUND	PRESSURE KSI	GAGE NO	STRAIN μ IN./IN.	GAGE NO	STRAIN μ IN./IN.	BODY VALVE	VALVE
153	10.	8	1500	2	1499	STD[1]	ST[2]
157	10.	8	1392	2	1564	STD	ST
160	10.	8	1294	2	1514	STD	ST
161	10.	8	1294	3	929	STD	ST
162	10.	8	1270	4	1515	STD	ST
163	10.5	8	1343	6	1344	STD	ST
164	10.	8	1343	7	684	STD	ST
165	10.	8	1171	7	489	STD	ST
166	10.	8	1146	6	1171	STD	M1[3]
167	10.5	8	1303	4	1564	STD	M1
168	9.5	8	1320	3	732	STD	M1
169	--	8	1171	2	1367	STD	M1
170	11.5	8	1292	2	1463	STD	M1
171	10.	8	805	2	927	STD	M2[4]
172	10.5	8	879	3	464	STD	M2
173	10.	8	879	4	976	STD	M2
174	10.	8	879	6	830	STD	M2
175	10.	8	879	7	244	STD	M2
176	9.5	8	488	7	196	STD	M3[5]
177	10.	8	439	7	196	STD	M3
178	10.	8	488	6	487	STD	M3
179	10.	8	438	4	544	STD	M3
180	10.5	8	439	3	342	STD	M3
181	10.5	8	410	2	512	STD	M3
183	10.75	1	214	8	1045	MB1[6]	ST
184	9.5	8	1522	1	192	MB1	ST
185	9.75	8	1423	2	1205	MB1	ST
186	9.5	8	1423	3	482	MB1	ST
187	10.5	8	1545	4	1260	MB1	ST
188	11.	8	1708	5	341	MB1	ST
189	10.5	8	1708	6	1783	MB1	ST
190	10.5	8	1611	7	684	MB1	ST
191	10.	8	1516	9	---	MB1	ST
192	10.	8	1439	9	3710	MB1	ST
193	10.	8	1805	10	4500^+	MB1	ST
194	10.	8	1689	11	4340	MB1	ST
195	10.	8	1196	11	2976	MB1	ST
196	10.	8	1408	9	3705	MB1	M1
197	10.5	8	1630	7	684	MB1	M1
198	10.5	8	976	6	889	MB1	M1

TABLE I (CONT.)

BORE EVACUATOR VALVE TEST FIRING DATA WITH OPTIMUM ORIFICE .1562" IN DIAMETER

ROUND	PRESSURE KSI	GAGE NO	STRAIN μ IN./IN.	GAGE NO	STRAIN μ IN./IN	BODY VALVE	VALVE
199	10.	8	1333	5	297	MB1	M1
200	11.5	8	1300	4	1250	MB1	M1
201	11.	8	1234	3	643	MB1	M1
202	10.	8	1333	2	1284	MB1	M1
203	10.	8	1300	1	198	MB1	M1
207	--	8	1043	1	174	MB1	M2
208	10.	8	843	1	88	MB1	M2
209	9.5	8	913	2	740	MB1	M2
210	10.5	8	804	3	326	MB1	M2
211	10.5	8	956	4	807	MB1	M2
212	10.5	8	914	5	174	MB1	M2
213	10.5	8	826	6	913	MB1	M2
214	10.	8	870	7	383	MB1	M2
215	9.25	8	739	9	1956	MB1	M2
216	11.25	8	956	11	2366	MB1	M2
217	10.	8	326	11	870	MB1	M2
218	9.75	8	326	9	913	MB1	M3
219	9.25	8	356	9	847	MB1	M3
220	11.	8	345	7	165	MB1	M3
221	10.	8	354	6	441	MB1	M3
222	9.75	8	322	5	66	MB1	M3
223	12.	8	418	4	315	MB1	M3
224	10.	8	444	3	152	MB1	M3
225	11.5	8	409	2	380	MB1	M3
226	8.75	8	261	1	---	MB1	M3
230	10.	8	862	2	805	MB2[7]	ST
231	10.5	8	840	3	892	MB2	ST
232	8.	8	831	4	1273	MB2	ST
233	9.	8	817	5	846	MB2	ST
234	10.75	8	953	6	646	MB2	ST
235	10.	8	1021	7	768	MB2	ST
236	11.5	8	1134	9	---	MB2	ST
237	10.5	8	1158	9	---	MB2	ST
238	10.5	8	1169	9	5910	MB2	ST
239	10.	8	844	9	4775	MB2	ST
240	10.	8	977	10	4555	MB2	ST
241	9.	8	933	11	5540	MB2	ST
242	10.5	8	965	12	4345	MB2	ST
248	--	8	910	12	4505	MB2	M1
249	9.	8	998	12	4395	MB2	M1

TABLE I (CONT.)

BORE EVACUATOR VALVE TEST FIRING DATA
WITH OPTIMUM ORIFICE .1562" IN DIAMETER

ROUND	PRESSURE KSI	GAGE NO	STRAIN μ IN./IN.	GAGE NO	STRAIN μ IN./IN	BODY VALVE	VALVE
250	9.5	8	910	11	5420	MB2	M1
251	10.	8	955	10	3904	MB2	M1
252	10.5	8	933	9	4830	MB2	M1
253	9.5	8	907	7	653	MB2	M1
254	10.5	8	1066	6	609	MB2	M1
255	10.	8	953	5	764	MB2	M1
256	10.	8	908	4	1031	MB2	M1
257	12.25	8	726	3	733	MB2	M1
258	10.	8	1134	2	653	MB2	M1
259	11.	8	1089	1	702	MB2	M1
262	9.	8	636	12	2750	MB2	M2
263	11.25	8	635	11	4180	MB2	M2
264	9.5	8	636	10	3190	MB2	M2
265	8.75	8	704	9	4180	MB2	M2
266	11.5	8	746	7	638	MB2	M2
267	11.	8	704	6	440	MB2	M2
268	9.5	8	590	5	618	MB2	M2
269	9.5	8	703	4	880	MB2	M2
270	10.	8	749	3	704	MB2	M2
271	9.5	8	704	2	616	MB2	M2
272	10.75	8	703	1	440	MB2	M2
273	9.5	8	322	12	1650	MB2	M3
274	10.	8	242	12	1363	MB2	M3
275	8.75	8	356	11	--	MB2	M3
276	9.75	8	322	11	2284	MB2	M3
277	9.	8	230	9	1584	MB2	M3
278	10.	8	345	10	1716	MB2	M3
279	9.5	8	276	7	264	MB2	M3
280	9.5	8	311	6	264	MB2	M3
281	10.	8	368	5	418	MB2	M3
282	9.5	8	299	4	451	MB2	M3
283	10.	8	368	3	377	MB2	M3
284	8.	8	291	2	244	MB2	M3
285	9.25	8	356	1	189	MB2	M3
286	--	3	1862	6	225	S3[8]	ST
287	9.5	3	1842	6	270	S3	ST
288	10.	3	1910	4	1012	S3	ST
289	9.	3	1793	2	2709	S3	ST
290	10.25	-	----	2	2812	S3	ST
291	9.25	3	1931	2	2655	S3	ST

TABLE I (CONT.)

BORE EVACUATOR VALVE TEST FIRING DATA
WITH OPTIMUM ORIFICE .1562" IN DIAMETER

ROUND	PRESSURE KSI	GAGE NO	STRAIN μ IN./IN.	GAGE NO	STRAIN μ IN./IN.	BODY VALVE	VALVE
292	11.	3	2022	7	3330	S3	ST
293	9.25	3	1840	8	2790	S3	ST
294	9.75	3	604	8	1229	S3	M3
295	9.5	3	644	8	1137	S3	M3
296	9.75	3	605	7	1023	S3	M3
297	10.75	3	651	2	1136	S3	M3
298	10.25	3	628	2	1146	S3	M3
299	9.5	3	697	7	1318	S3	M3
300	8.25	3	604	8	1000	S3	M3
301	--	3	628	-	--	S3	M3
302	9.75	3	651	-	--	S3	M3
303	10.25	3	1161	-	--	S3	M2
304	11.	3	1674	-	--	S3	M1
305	10.	3	1720	-	--	S3	ST
308	10.5	3	1862	-	--	S3	M1
309	10.5	3	1884	-	--	S3	M1
310	11.	3	1242	-	--	S3	M2
311	11.5	3	621	-	--	S3	M3

1 BODY (VALVE) B8769382, FIGURE 11; STRAIN GAGE LOCATIONS, FIGURE 28.

2 STANDARD PRODUCTION VALVE AT TIME OF TEST, FIGURE 7.

3 FIRST MODIFIED VALVE 1/2" DEEP HOLE FIGURE 8.

4 MODIFIED VALVE TWO 5/8" DEEP HOLE, FIGURE 9.

5 ADOPTED MODIFICATION FIGURE 10.

6 SHORTENED BODY (VALVE) RDI-B7212, FIGURE 12; STRAIN GAGE LOCATIONS, FIGURE 29.

7 ADOPTED MODIFIED BODY (VALVE) B8769530, FIGURE 13; STRAIN GAGE LOCATIONS, FIGURE 30.

8 BODY (VALVE) B8769382, FIGURE 11, STRAIN GAGE LOCATIONS, FIGURE 31.

TABLE II

REDUCTION IN STRAIN WITH VARIOUS VALVE COMPONENTS

VALVE*		STRAIN μ IN./IN.				% OF ST VALVE		
BODY VALVE*	GAGE NO	ST[2]	M1[3]	M2[4]	M3[5]	M1	M2	M3
STD[1]	2	1536	1275	925	480	83.0	60.3	31.2
	3	930	770	440	325	82.9	47.4	35.0
	4	1515	1490	975	545	98.5	64.4	36.9
	6	1280	1170	830	480	91.5	64.8	37.5
	7	680	460	240	190	67.7	35.4	28.0
	8	1300	1185	855	445	91.2	68.0	34.2
MB1[6]	1	205	195	88	---			
	2	1230	1280	780	330	104.0	63.4	26.8
	3	510	590	310	160	115.5	52.6	27.1
	4	1200	1090	760	260	91.8	63.4	21.7
	5	310	290	170	65	93.6	59.9	21.0
	6	1700	845	870	445	49.7	51.1	26.2
	7	650	650	385	145	100.0	59.3	22.3
	8	1560	1250	900	350	80.2	57.7	22.4
	9	3700	3700	2125	875	100.0	57.5	23.7
	11	4300	2950	2100	875	68.6	48.8	20.3
MB2[7]	1	610	630	410	200	103.0	67.2	32.8
	2	805	655	650	305	81.4	80.7	37.9
	3	850	600	700	375	70.6	82.4	44.1
	4	1590	1035	925	480	65.0	58.2	30.2
	5	890	765	650	365	85.0	73.0	41.0
	6	600	590	400	420	98.5	65.7	70.0
	7	765	690	555	275	90.2	72.5	35.9
	8	940	990	685	335	105.2	72.9	35.6
	9	5200	4600	4750	1740	88.5	91.4	33.5
	10	4550	3900	3350	1740	85.7	73.6	38.2
	11	6150	5700	3725	2350	93.5	60.6	38.2
	12	4150	4850	3040	1550	117.0	73.4	37.4

* KEY AT BOTTOM OF TABLE I APPLIES

TABLE III

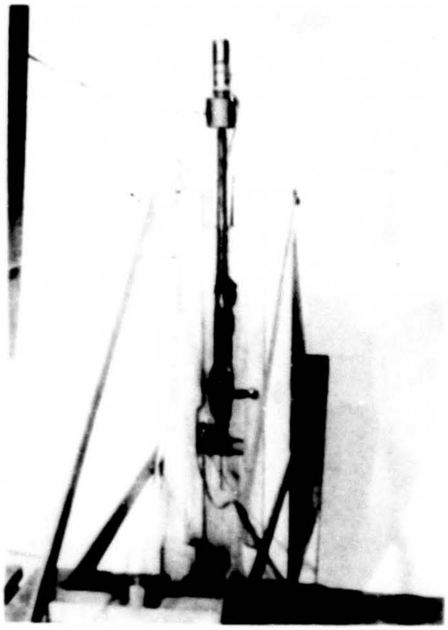
NUMBER OF ROUNDS ON VALVE ASSEMBLIES AT PROOF HOUSE OF WATERVLIET ARSENAL

ASSEMBLY NUMBER	TEST DESIGNATION	ROUNDS UNTIL FIRST INDICATION	TOTAL NUMBER OF ROUNDS
B8769384	S.V. 1	455	1000
B8769384	S.V. 2	501	1300
B8769384	S.V. 3	393	1000
B8769384	S.V. 4	145	1000
B8769531	M.V. 1	8051	10000
B8769531	M.V. 2	----	5000
B8769531	M.V. 3	5711	10000

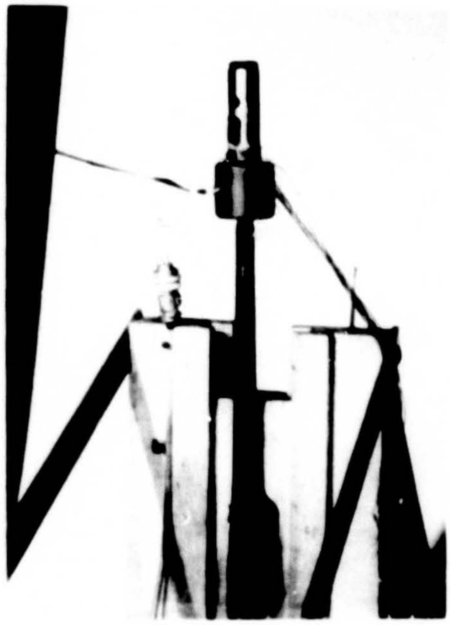
TABLE IV

AVERAGE NUMBER OF ROUNDS ON VALVE ASSEMBLIES FROM DIFFERENT CHARGES

LOCATION OF FIRING	PROOF HOUSE	EPG	EPG	APG
PROPELLANT CHARGE	TEST APPARATUS	100%+ 115%RMP	100%RMP	XM119E1
VALVE ASSEMBLY				
B8769531	6890	1000	----	230
B8769384	400	----	280	100

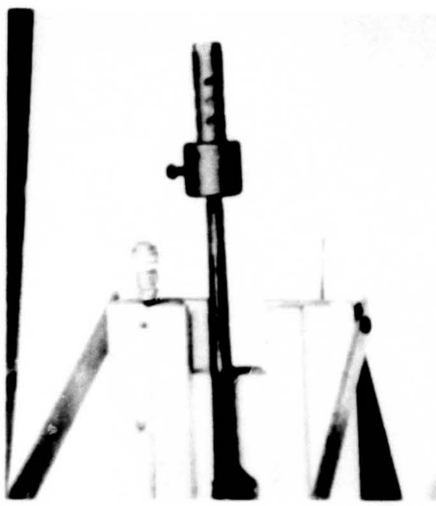


A



B

C



D

Figure 1: Test Apparatus
A. General View of Test Stand.
B. Close-up of strain-gaged valve assembly and side pressure pick-up.
C. End pressure adapter and pressure pick-up in place of valve.
D. Valve installed for fatigue test.

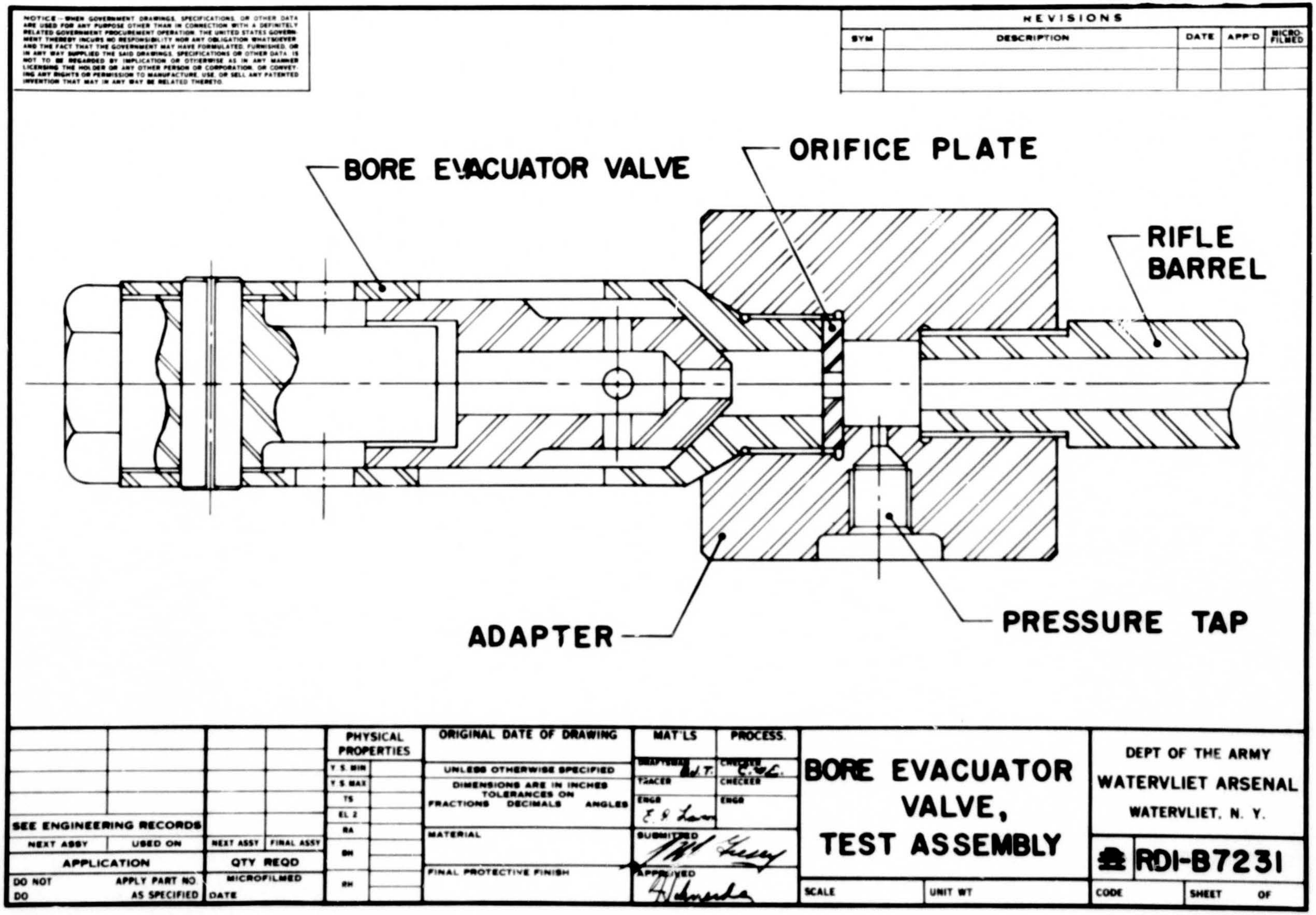
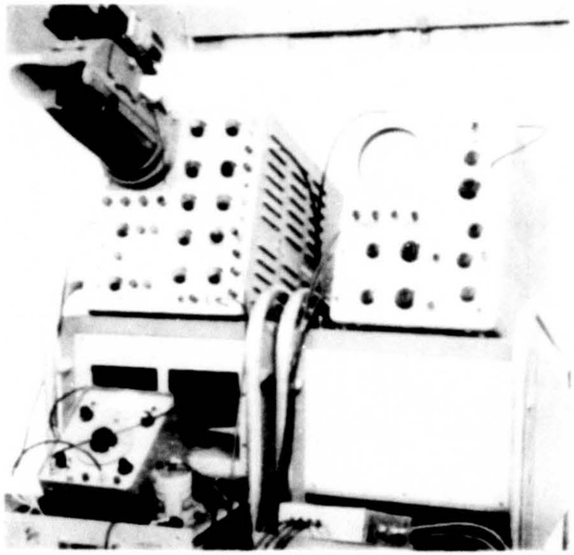

BORE EVACUATOR VALVE
ORIFICE PLATE
RIFLE BARREL
ADAPTER
PRESSURE TAP
REVISIONS
SYM
DESCRIPTION
DATE
APP'D
MICRO-FILMED
SEE ENGINEERING RECORDS
NEXT ASSY
USED ON
NEXT ASSY
FINAL ASSY
APPLICATION
QTY REQD
DO NOT APPLY PART NO
DO AS SPECIFIED
MICROFILMED
DATE
PHYSICAL PROPERTIES
ORIGINAL DATE OF DRAWING
UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
FRACTIONS DECIMALS ANGLES
MATERIAL
FINAL PROTECTIVE FINISH
MAT'LS
PROCESS.
TRACER
CHECKER
ENGR
SUBMITTED
APPROVED
BORE EVACUATOR VALVE, TEST ASSEMBLY
SCALE
UNIT WT
DEPT OF THE ARMY
WATERVLIET ARSENAL
WATERVLIET, N. Y.
RDI-B7231
CODE
SHEET OF

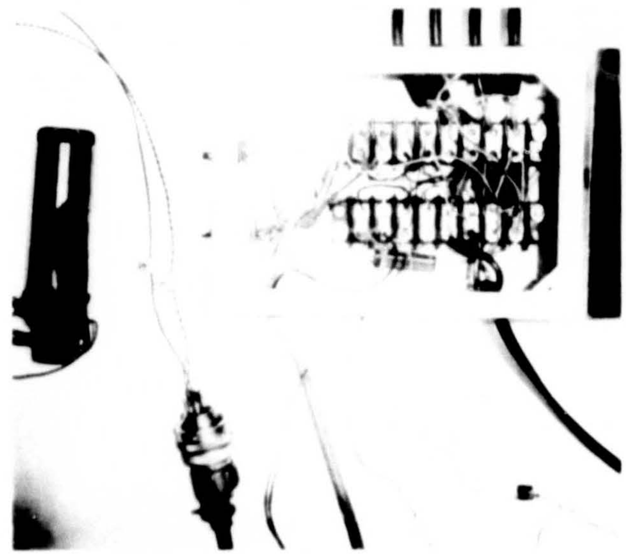
FIGURE 2



A

To the left Figure 3A
Two oscilloscopes used to record data. Oscilloscope on left records pressure. Kistler calibration unit is shown below scope. Scope on right records strains. The strain gage calibration junction box is shown below scope.

To the right Figure 3B
Close-up showing equipment used in Strain Gage Circuit.



B

Figure 3: Test Instruments

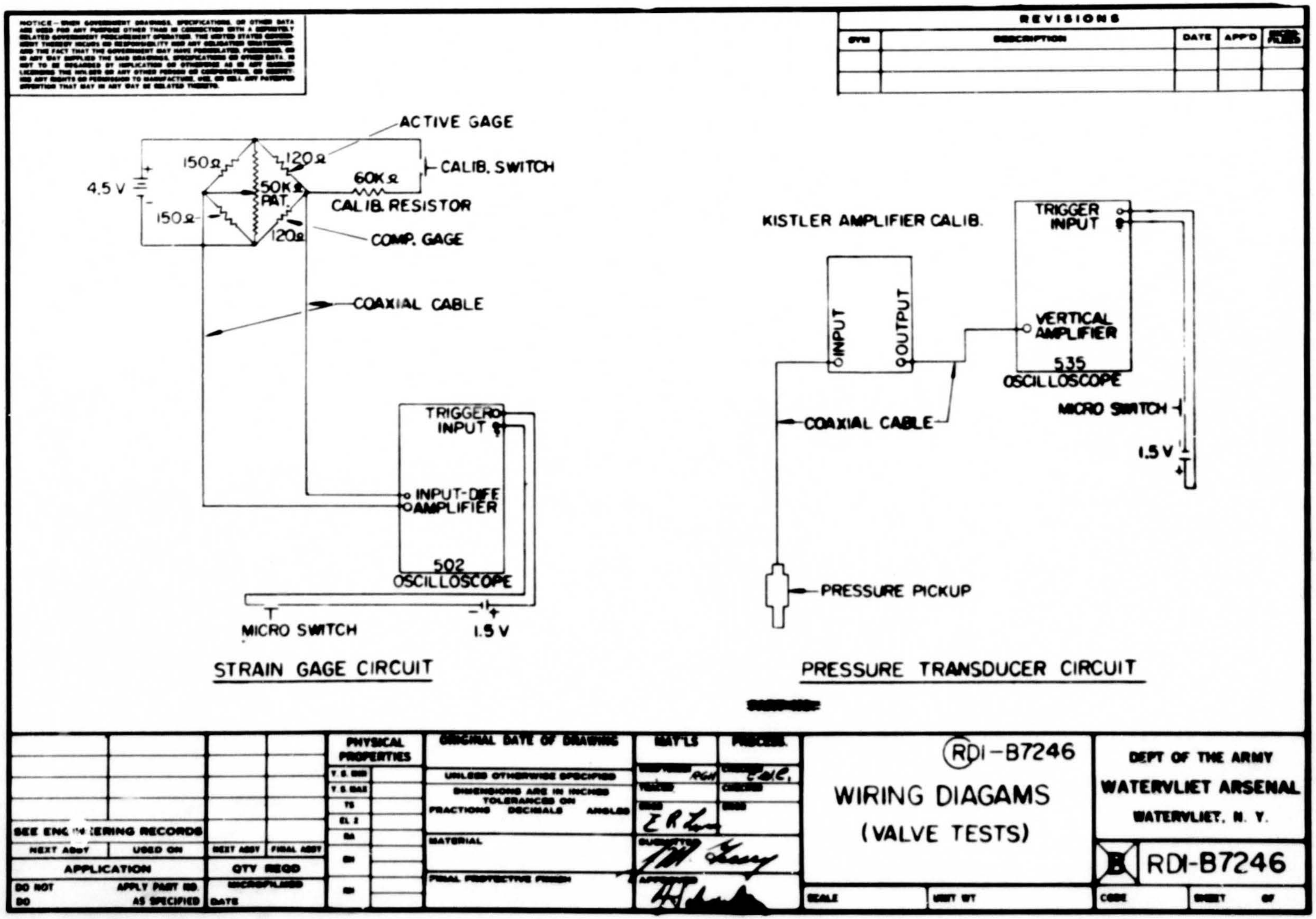

ACTIVE GAGE
4.5 V
150Ω
150Ω
120Ω
120Ω
50KΩ
POT.
60KΩ
CALIB. SWITCH
CALIB. RESISTOR
COMP. GAGE
COAXIAL CABLE
TRIGGER
INPUT
INPUT-DIFF
AMPLIFIER
502
OSCILLOSCOPE
MICRO SWITCH
1.5 V
STRAIN GAGE CIRCUIT
KISTLER AMPLIFIER CALIB.
INPUT
OUTPUT
TRIGGER
INPUT
VERTICAL
AMPLIFIER
535
OSCILLOSCOPE
MICRO SWITCH
1.5 V
COAXIAL CABLE
PRESSURE PICKUP
PRESSURE TRANSDUCER CIRCUIT
REVISIONS
DESCRIPTION
DATE
APP'D
SEE ENGINEERING RECORDS
NEXT ASSY
USED ON
APPLICATION
DO NOT
APPLY PART NO.
AS SPECIFIED
QTY REQD
PHYSICAL PROPERTIES
ORIGINAL DATE OF DRAWING
UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
FRACTIONS DECIMALS ANGLES
MATERIAL
FINAL PROTECTIVE FINISH
MAT'LS
PROCESS
RDI-B7246
WIRING DIAGAMS
(VALVE TESTS)
SCALE
UNIT WT
DEPT OF THE ARMY
WATERVLIET ARSENAL
WATERVLIET, N. Y.
RDI-B7246
CODE
SHEET
OF

FIGURE 4

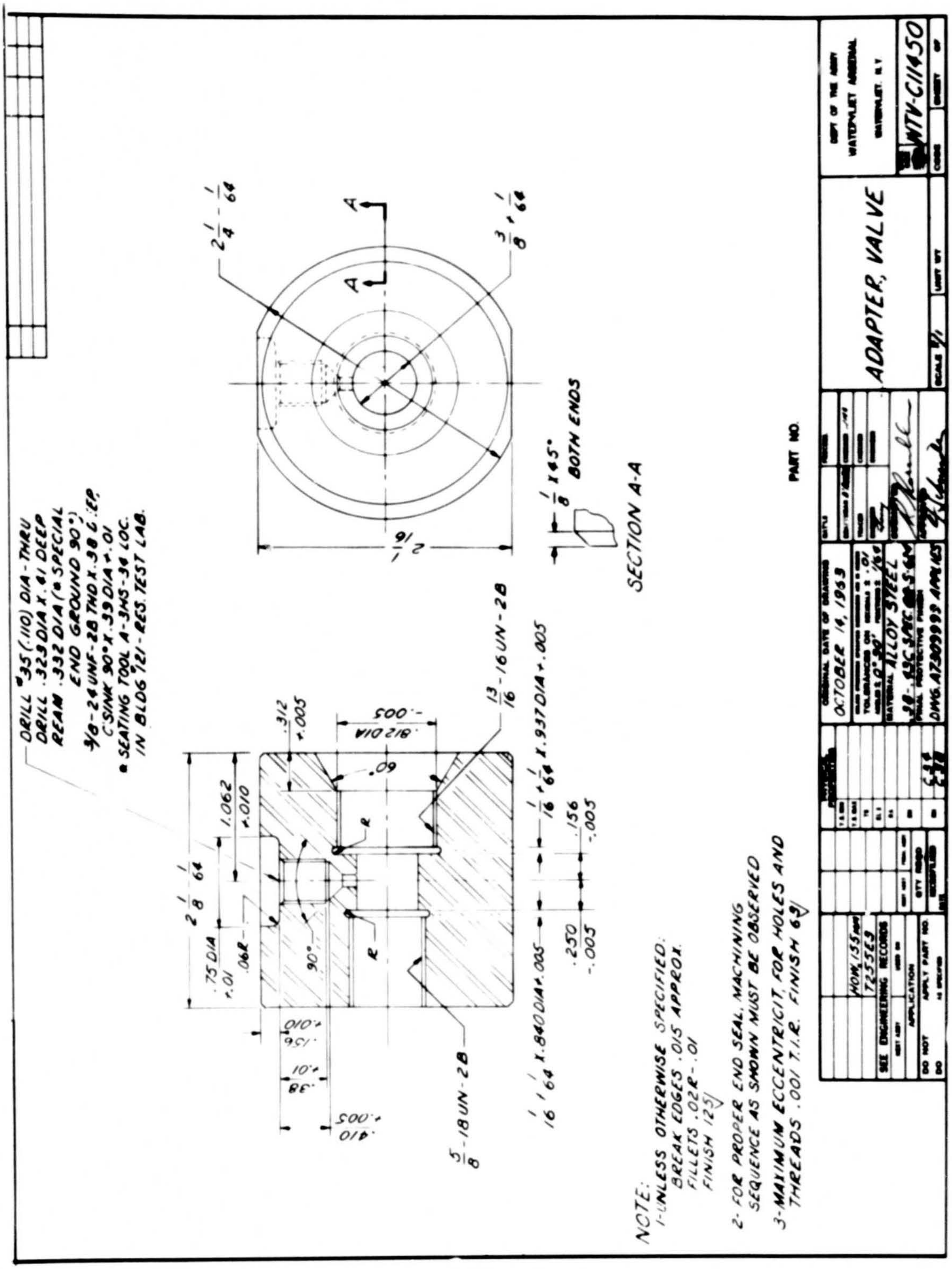

ADAPTER, VALVE
WTV-C11450
DEPT OF THE ARMY
WATERVLIET ARSENAL
WATERVLIET, N.Y.
OCTOBER 16, 1959
SECTION A-A
BOTH ENDS
PART NO.
NOTE:
1-UNLESS OTHERWISE SPECIFIED:
BREAK EDGES .015 APPROX.
FILLETS .02R-.01
FINISH 125
2-FOR PROPER END SEAL, MACHINING
SEQUENCE AS SHOWN MUST BE OBSERVED
3-MAXIMUM ECCENTRICIT, FOR HOLES AND
THREADS .001 T.I.R. FINISH 63
DRILL #35 (.110) DIA-THRU
DRILL .323 DIA X .41 DEEP
REAM .332 DIA (SPECIAL END GROUND 90°)
3/8-24 UNF-2B THD X .38 DEEP
C'SINK 90° X .39 DIA +.01
SEATING TOOL A-3HS-34 LOC. IN BLDG 121-RES. TEST LAB.
5/8-18UN-2B
13/16-16UN-2B
ALLOY STEEL

FIGURE 5

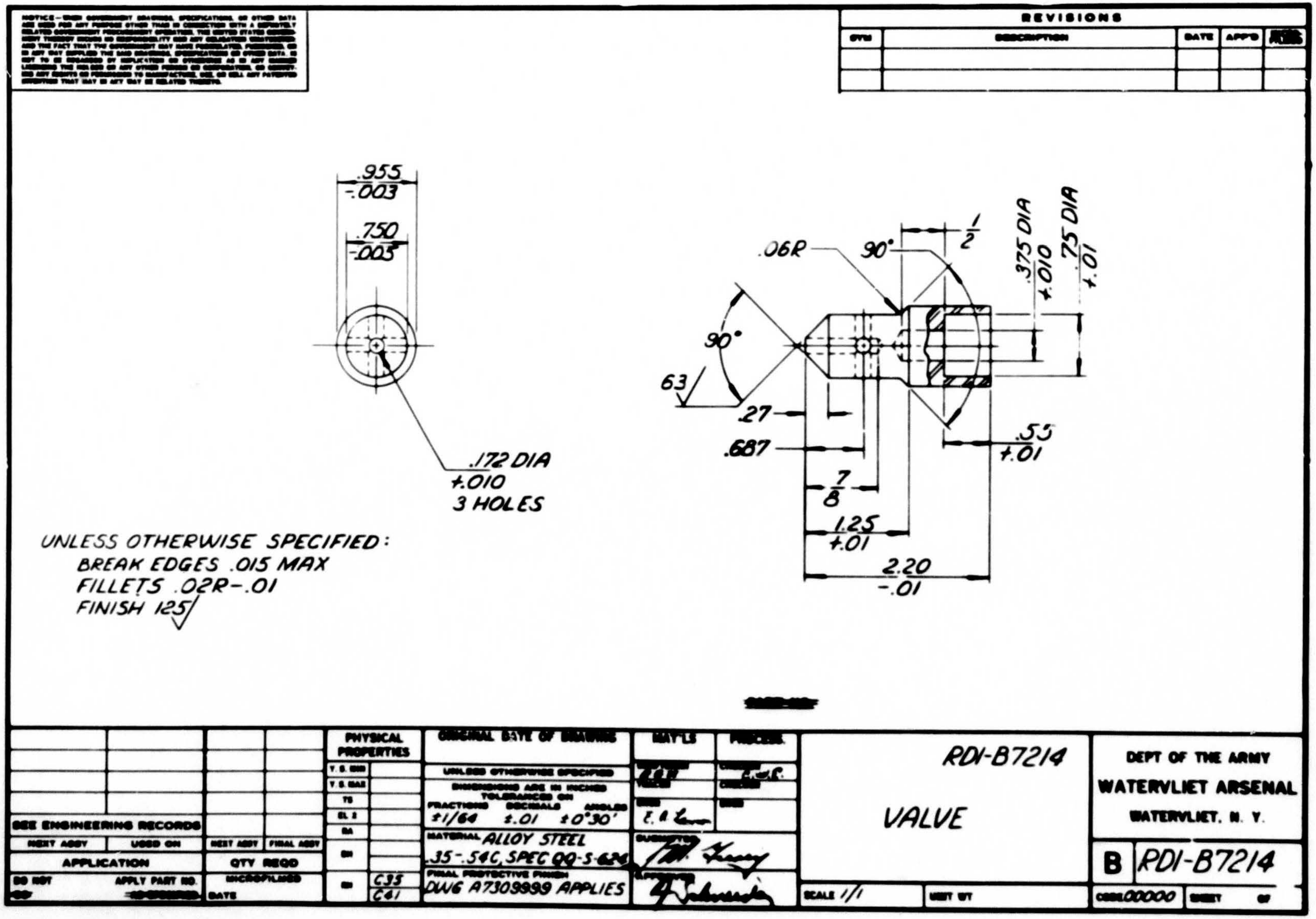

REVISIONS
.955
-.003
.750
-.003
.172 DIA
±.010
3 HOLES
UNLESS OTHERWISE SPECIFIED:
BREAK EDGES .015 MAX
FILLETS .02R-.01
FINISH 125
.06R
90°
1/2
.375 DIA
±.010
.75 DIA
±.01
90°
63
.27
.687
.55
±.01
7/8
1.25
±.01
2.20
-.01
PHYSICAL PROPERTIES
ORIGINAL DATE OF DRAWING
DIMENSIONS ARE IN INCHES
±1/64 ±.01 ±0°30'
MATERIAL ALLOY STEEL
.35-.54C, SPEC QQ-S-634
DWG A7309999 APPLIES
SEE ENGINEERING RECORDS
APPLICATION
QTY REQD
C35
C41
RDI-B7214
VALVE
SCALE 1/1
DEPT OF THE ARMY
WATERVLIET ARSENAL
WATERVLIET, N. Y.
B RDI-B7214
CODE 00000

FIGURE 8

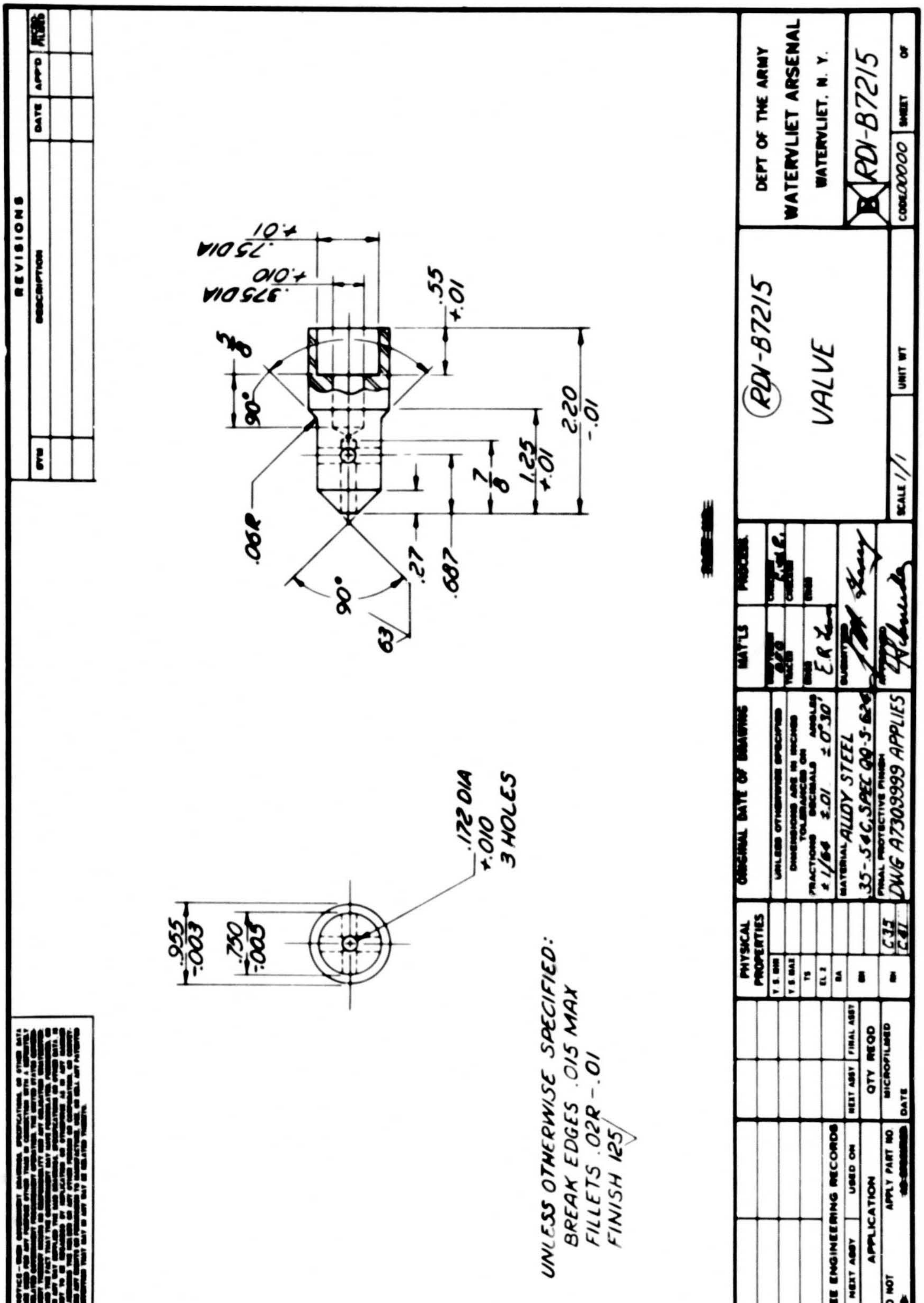

REVISIONS
DESCRIPTION
DATE
APP'D
.172 DIA
+.010
3 HOLES
.955
-.003
.750
-.005
.375 DIA
+.010
.75 DIA
+.01
.05R
90°
63
.27
.687
7/8
1.25
+.01
2.20
-.01
.55
+.01
UNLESS OTHERWISE SPECIFIED:
BREAK EDGES .015 MAX
FILLETS .02R -.01
FINISH 125
SEE ENGINEERING RECORDS
NEXT ASSY
USED ON
APPLICATION
QTY REQD
PHYSICAL PROPERTIES
ORIGINAL DATE OF DRAWING
UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
FRACTIONS DECIMALS ANGLES
±1/64 ±.01 ±0°30'
MATERIAL ALLOY STEEL
DWG A7309999 APPLIES
RDI-B7215
VALVE
SCALE 1/1
UNIT WT
DEPT OF THE ARMY
WATERVLIET ARSENAL
WATERVLIET, N. Y.
RDI-B7215
SHEET
OF

FIGURE 9

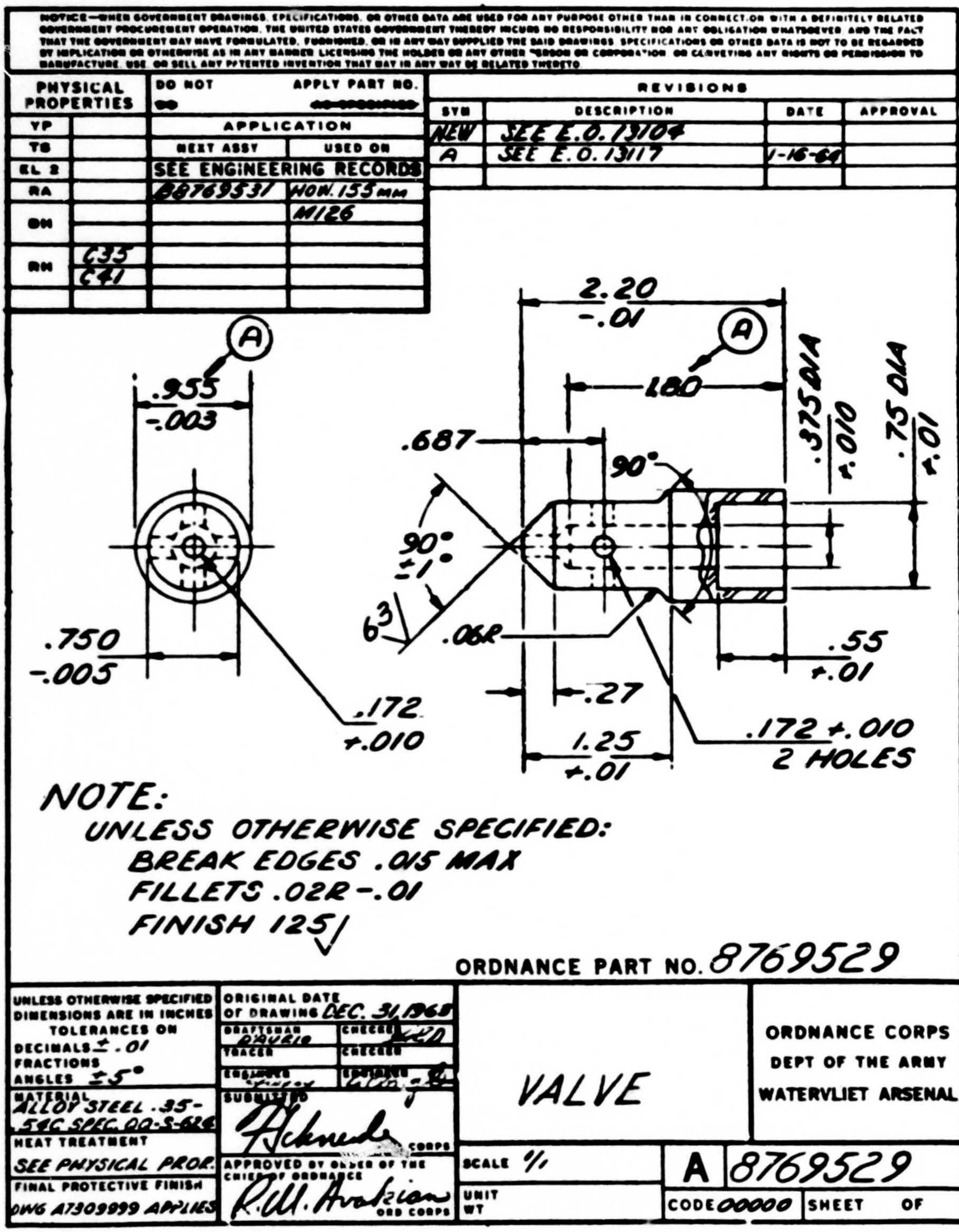

NOTICE—WHEN GOVERNMENT DRAWINGS, SPECIFICATIONS, OR OTHER DATA ARE USED FOR ANY PURPOSE OTHER THAN IN CONNECTION WITH A DEFINITELY RELATED GOVERNMENT PROCUREMENT OPERATION, THE UNITED STATES GOVERNMENT THEREBY INCURS NO RESPONSIBILITY NOR ANY OBLIGATION WHATSOEVER, AND THE FACT THAT THE GOVERNMENT MAY HAVE FORMULATED, FURNISHED, OR IN ANY WAY SUPPLIED THE SAID DRAWINGS, SPECIFICATIONS OR OTHER DATA IS NOT TO BE REGARDED BY IMPLICATION OR OTHERWISE AS IN ANY MANNER LICENSING THE HOLDER OR ANY OTHER PERSON OR CORPORATION, OR CONVEYING ANY RIGHTS OR PERMISSION TO MANUFACTURE, USE, OR SELL ANY PATENTED INVENTION THAT MAY IN ANY WAY BE RELATED THERETO
PHYSICAL PROPERTIES
DO NOT
APPLY PART NO.
REVISIONS
SYM
DESCRIPTION
DATE
APPROVAL
NEW
SEE E.O. 13104
A
SEE E.O. 13117
1-16-64
APPLICATION
NEXT ASSY
USED ON
SEE ENGINEERING RECORDS
B8769531
HOW. 155mm
M126
YP
TS
EL 2
RA
BH
RH
C35
C41
2.20
-.01
1.80
.687
90°
.375 DIA
+.010
.75 DIA
+.01
.955
-.003
90°
±1°
.06R
.750
-.005
.55
+.01
.27
.172
+.010
1.25
+.01
.172 +.010
2 HOLES
NOTE:
UNLESS OTHERWISE SPECIFIED:
BREAK EDGES .015 MAX
FILLETS .02R-.01
FINISH 125
ORDNANCE PART NO. 8769529
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMALS ± .01
FRACTIONS
ANGLES ± 5°
MATERIAL
ALLOY STEEL .35-.54C SPEC. QQ-S-626
HEAT TREATMENT
SEE PHYSICAL PROP.
FINAL PROTECTIVE FINISH
DWG A7309999 APPLIES
ORIGINAL DATE OF DRAWING DEC. 31, 1963
DRAFTSMAN
CHECKED
TRACER
CHECKED
ENGINEER
SUBMITTED
CORPS
APPROVED BY ORDER OF THE CHIEF OF ORDNANCE
ORD CORPS
VALVE
ORDNANCE CORPS
DEPT OF THE ARMY
WATERVLIET ARSENAL
SCALE 1/1
UNIT WT
A 8769529
CODE 00000
SHEET
OF

FIGURE 10

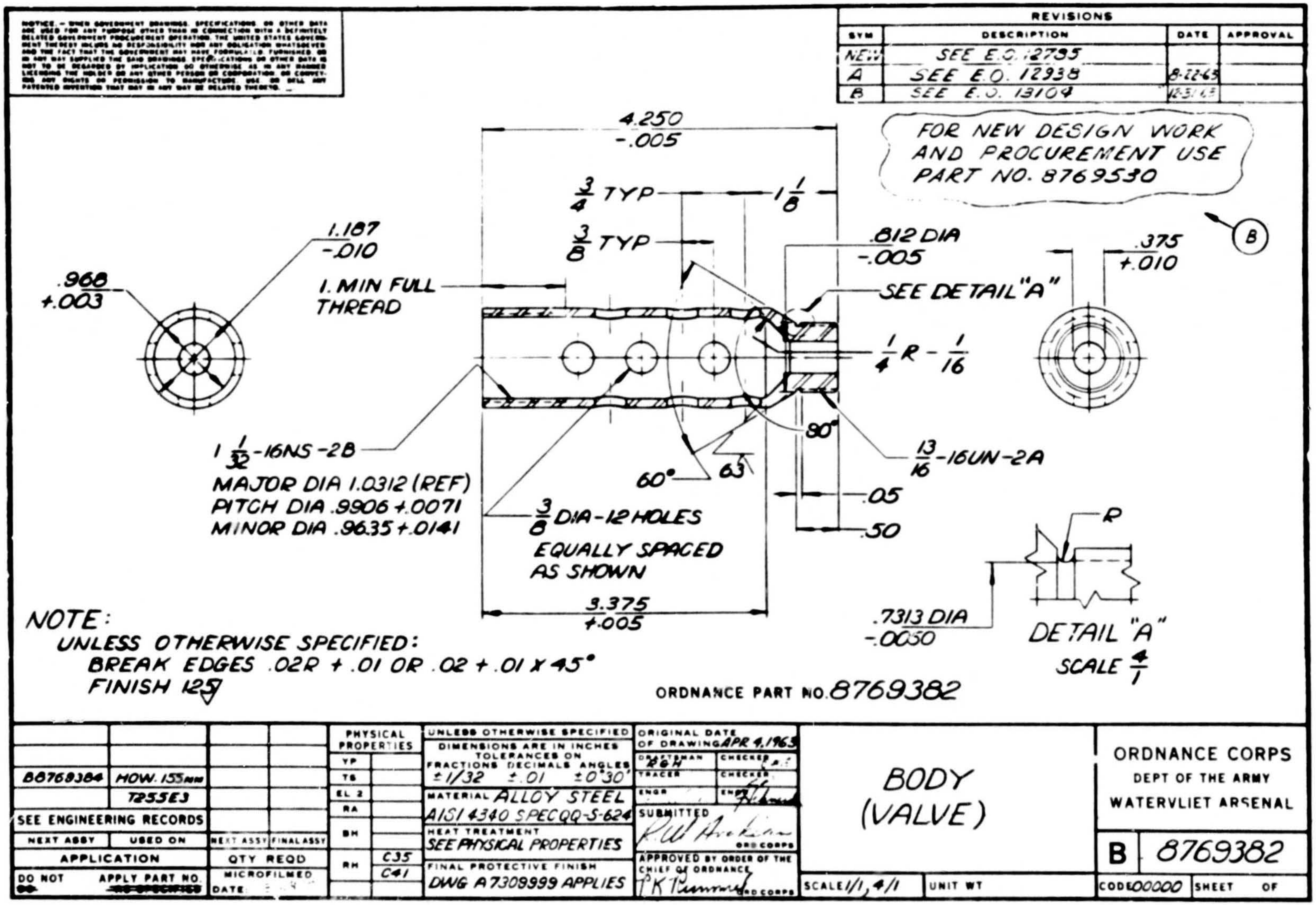
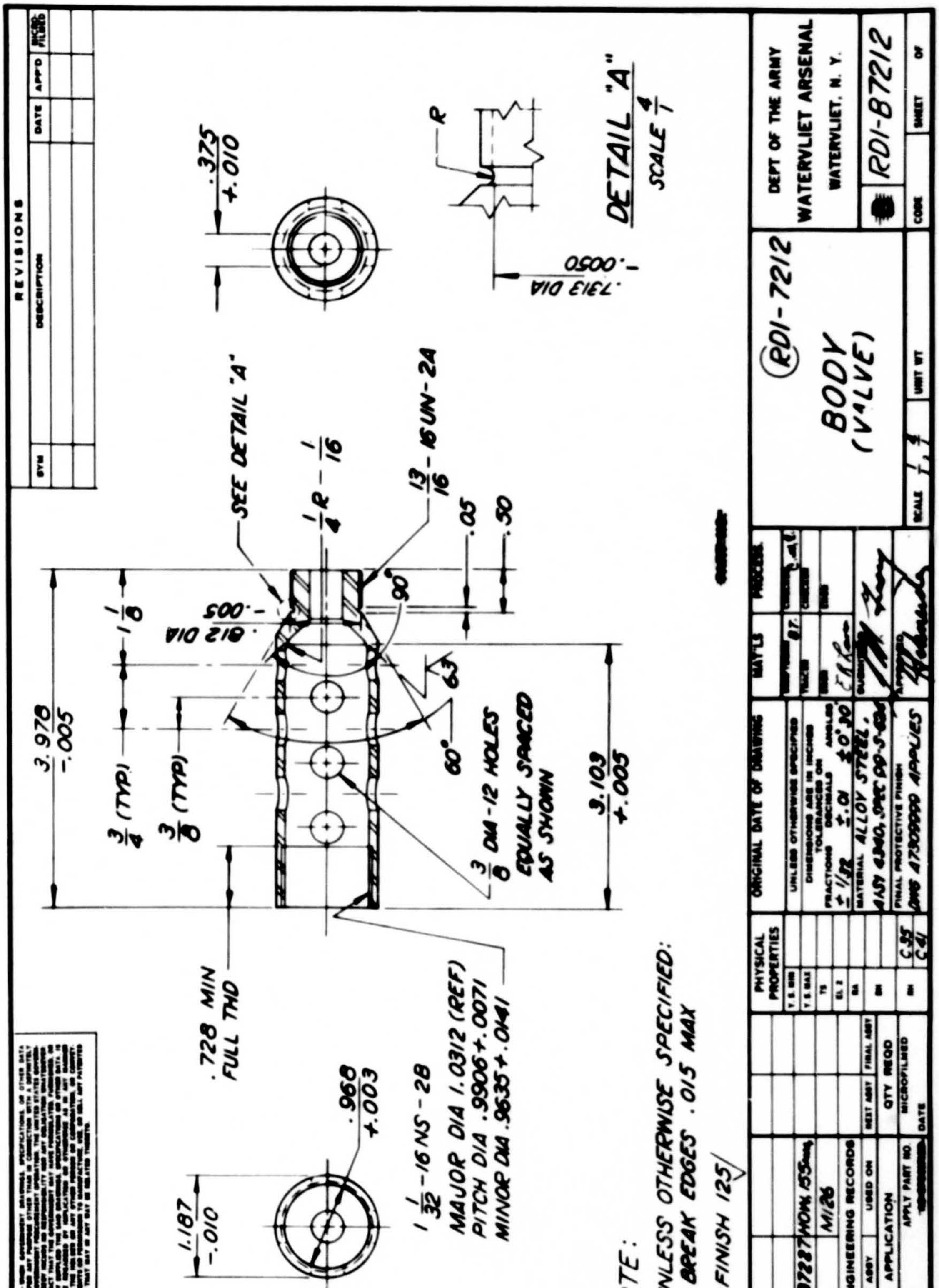

REVISIONS
SYM | DESCRIPTION | DATE | APPROVAL
NEW SEE E.O. 12795
A SEE E.O. 12938 8-22-63
B SEE E.O. 13104
FOR NEW DESIGN WORK AND PROCUREMENT USE PART NO. 8769530
4.250 -.005
3/4 TYP
1 1/8
3/8 TYP
1.187 -.010
.968 +.003
1. MIN FULL THREAD
.812 DIA -.005
SEE DETAIL "A"
.375 +.010
1/4 R - 1/16
80°
13/16-16UN-2A
1 1/32-16NS-2B
MAJOR DIA 1.0312 (REF)
PITCH DIA .9906 +.0071
MINOR DIA .9635 +.0141
60°
63
3/8 DIA-12 HOLES EQUALLY SPACED AS SHOWN
.05
.50
R
3.375 +.005
.7313 DIA -.0050
DETAIL "A" SCALE 4/1
NOTE:
UNLESS OTHERWISE SPECIFIED:
BREAK EDGES .02R + .01 OR .02 + .01 X 45°
FINISH 125
ORDNANCE PART NO. 8769382
B8769384 HOW. 155mm T255E3
SEE ENGINEERING RECORDS
NEXT ASSY USED ON
APPLICATION
DO NOT APPLY PART NO.
NEXT ASSY FINAL ASSY
QTY REQD
MICROFILMED DATE
PHYSICAL PROPERTIES
YP TS EL 2 RA BH RH C35 C41
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON FRACTIONS DECIMALS ANGLES ±1/32 ±.01 ±0°30'
MATERIAL ALLOY STEEL AISI 4340 SPEC QQ-S-624
HEAT TREATMENT SEE PHYSICAL PROPERTIES
FINAL PROTECTIVE FINISH DWG A7308999 APPLIES
ORIGINAL DATE OF DRAWING APR 4, 1963
DRAFTSMAN RGH
CHECKER
TRACER
ENGR
SUBMITTED
ORD CORPS
APPROVED BY ORDER OF THE CHIEF OF ORDNANCE
ORD CORPS
BODY (VALVE)
SCALE 1/1, 4/1
UNIT WT
ORDNANCE CORPS
DEPT OF THE ARMY
WATERVLIET ARSENAL
B 8769382
CODE 00000 SHEET OF

FIGURE 11



REVISIONS
SYM
DESCRIPTION
DATE
APP'D
3.978
-.005
3/4 (TYP)
3/8 (TYP)
1 1/8
.812 DIA
-.005
SEE DETAIL "A"
1/4 R - 1/16
13/16 - 16UN-2A
.05
.50
90°
60°
63
3/8 DIA-12 HOLES
EQUALLY SPACED
AS SHOWN
3.103
+.005
.375
+.010
.7313 DIA
-.0050
R
DETAIL "A"
SCALE 4/1
1.187
-.010
.968
+.003
.728 MIN
FULL THD
1 1/32 -16NS-2B
MAJOR DIA 1.0312 (REF)
PITCH DIA .9906+.0071
MINOR DIA .9635+.0141
NOTE:
UNLESS OTHERWISE SPECIFIED:
BREAK EDGES .015 MAX
FINISH 125
DEPT OF THE ARMY
WATERVLIET ARSENAL
WATERVLIET, N. Y.
RDI-7212
BODY
(VALVE)
RDI-B7212
SCALE 1/1
UNIT WT
CODE
SHEET
OF
PHYSICAL PROPERTIES
ORIGINAL DATE OF DRAWING
UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
FRACTIONS DECIMALS ANGLES
± 1/32 ±.01 ±0°30'
MATERIAL ALLOY STEEL,
AISI 4340, SPEC QQ-S-626
FINAL PROTECTIVE FINISH
DWG A7309900 APPLIES
RDI-B7227 HOW, 155mm, M126
SEE ENGINEERING RECORDS
NEXT ASSY
USED ON
APPLICATION
QTY REQD
APPLY PART NO.
MICROFILMED
DATE

FIGURE 12

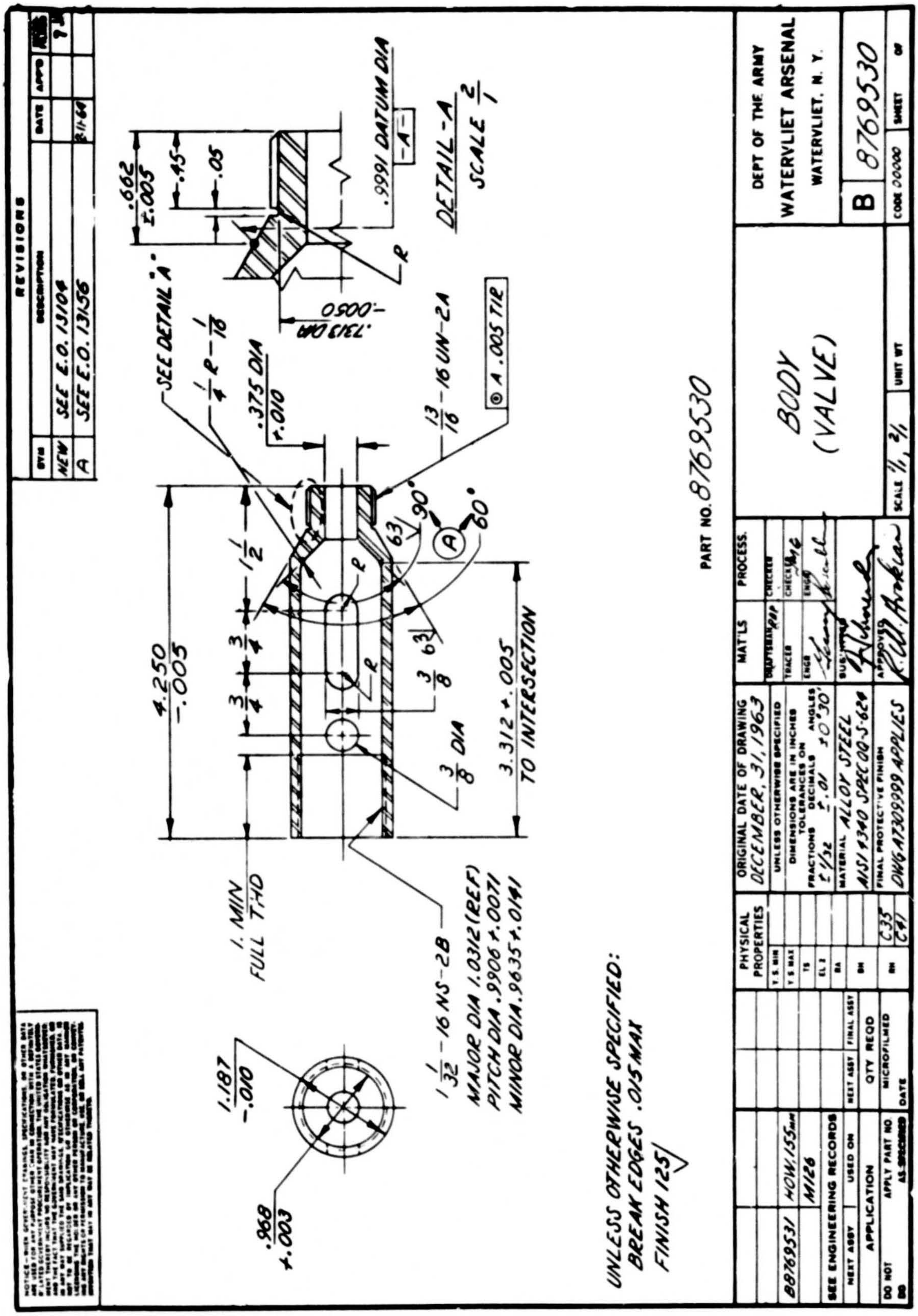

REVISIONS
SEE E.O. 13104
SEE E.O. 13156
SEE DETAIL "A"
.375 DIA
+.010
13/16 - 16 UN-2A
A .005 TIR
.9991 DATUM DIA
-A-
DETAIL-A
SCALE 2/1
4.250
-.005
3.312 +.005
TO INTERSECTION
3/8 DIA
1. MIN
FULL THD
1 1/32 - 16 NS-2B
MAJOR DIA 1.0312 (REF)
PITCH DIA .9906 +.0071
MINOR DIA .9635 +.0141
1.187
-.010
.968
+.003
UNLESS OTHERWISE SPECIFIED:
BREAK EDGES .015 MAX
FINISH 125
PART NO. 8769530
BODY
(VALVE)
DEPT OF THE ARMY
WATERVLIET ARSENAL
WATERVLIET, N. Y.
B 8769530
ORIGINAL DATE OF DRAWING
DECEMBER, 31, 1963
MATERIAL ALLOY STEEL
AISI 4340 SPEC QQ-S-624
DWG A7309999 APPLIES
8876953l
SEE ENGINEERING RECORDS

FIGURE 13

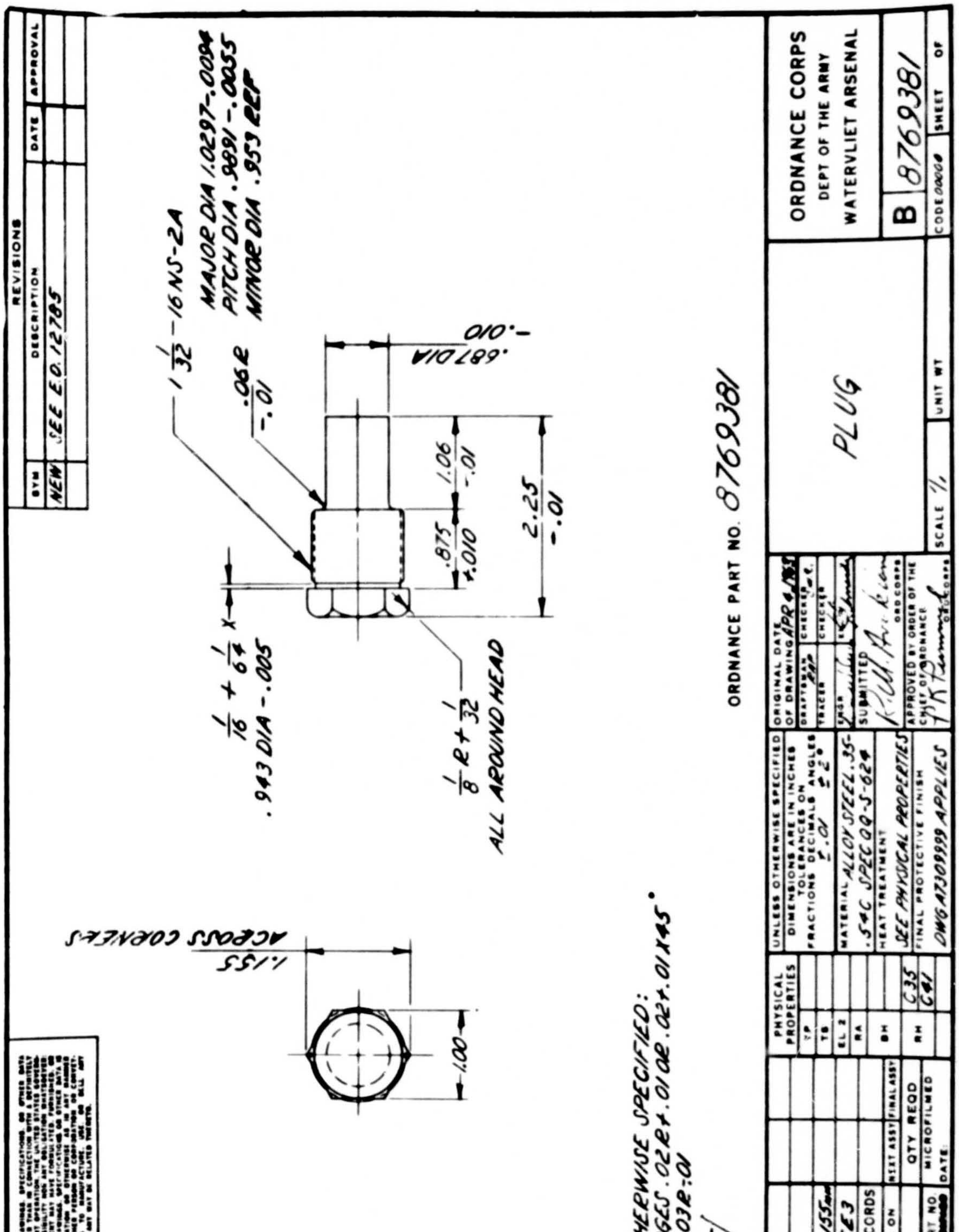

REVISIONS
SYM
DESCRIPTION
DATE
APPROVAL
NEW
SEE E.O. 12785
1 1/32 -16NS-2A
MAJOR DIA 1.0297-.0094
PITCH DIA .9891-.0055
MINOR DIA .953 REF
.687 DIA -.010
1/16 + 1/64 X .943 DIA -.005
1/8 R ± 1/32
ALL AROUND HEAD
.875 ±.010
1.06 -.01
2.25 -.01
1.155 ACROSS CORNERS
1.00
UNLESS OTHERWISE SPECIFIED:
BREAK EDGES .02R±.01 OR .02±.01X45°
FILLETS .03R±.01
FINISH 125
ORDNANCE PART NO. 8769381
PLUG
ORDNANCE CORPS
DEPT OF THE ARMY
WATERVLIET ARSENAL
B 8769381
SEE ENGINEERING RECORDS
8769384
HOW, 155mm
T255E3
NEXT ASSY
USED ON
APPLICATION
QTY REQD
MICROFILMED
DO NOT
APPLY PART NO
MATERIAL ALLOY STEEL .35-.54C SPEC QQ-S-624
HEAT TREATMENT
SEE PHYSICAL PROPERTIES
FINAL PROTECTIVE FINISH
DWG A7309999 APPLIES
SCALE 1/1
UNIT WT
CODE
SHEET
OF

FIGURE 14

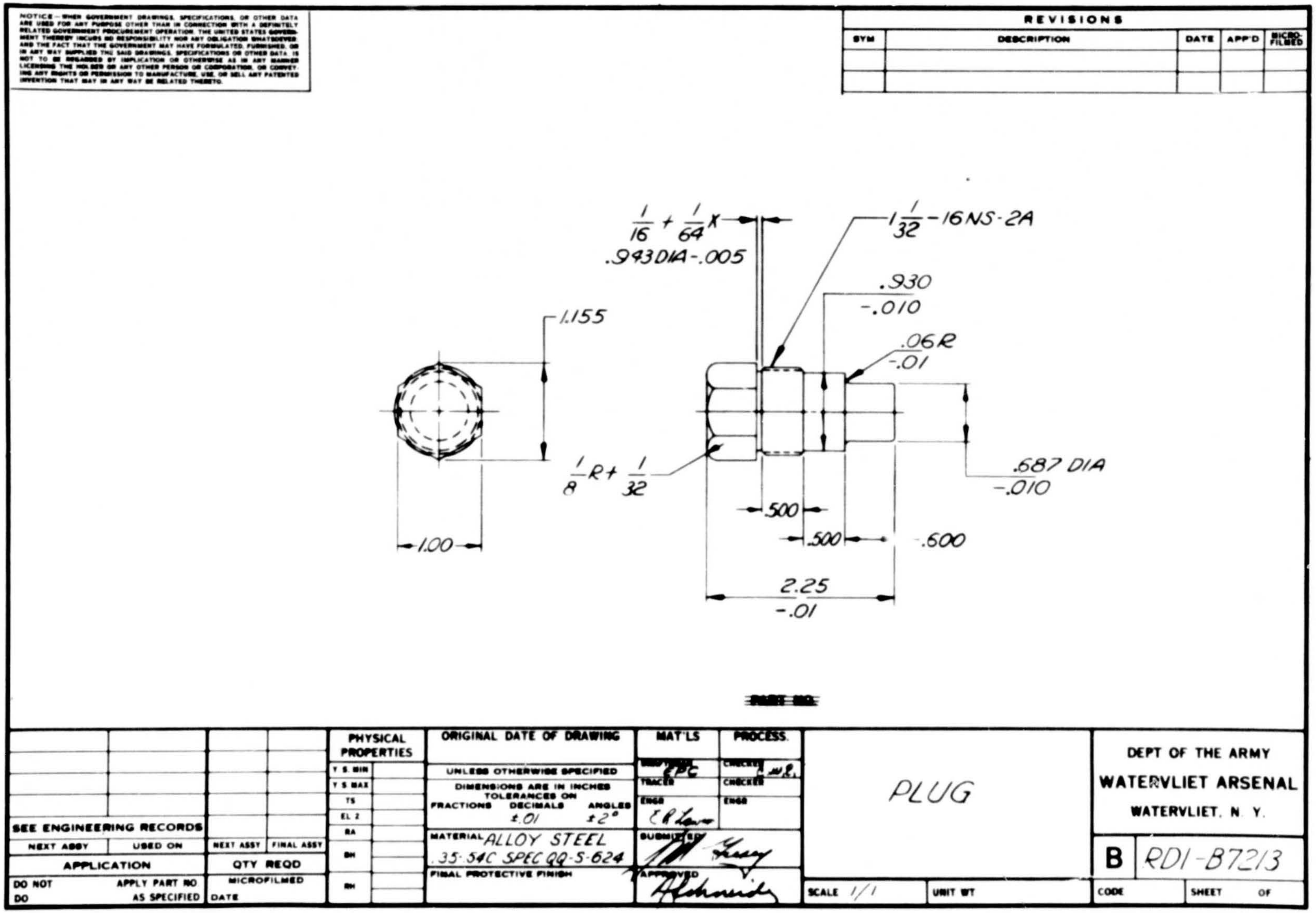

REVISIONS
SYM
DESCRIPTION
DATE
APP'D
MICRO-FILMED
1/16 + 1/64 X
.943 DIA -.005
1 1/32 - 16NS-2A
.930
-.010
1.155
.06R
-.01
1/8 R + 1/32
.687 DIA
-.010
.500
.500
.600
1.00
2.25
-.01
PHYSICAL PROPERTIES
ORIGINAL DATE OF DRAWING
MAT'LS
PROCESS
UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
FRACTIONS DECIMALS ANGLES
±.01 ±2°
MATERIAL ALLOY STEEL
.35-.54C SPEC QQ-S-624
FINAL PROTECTIVE FINISH
PLUG
DEPT OF THE ARMY
WATERVLIET ARSENAL
WATERVLIET, N. Y.
B RDI-B7213
SCALE 1/1
UNIT WT
CODE
SHEET OF
SEE ENGINEERING RECORDS
NEXT ASSY
USED ON
NEXT ASSY
FINAL ASSY
APPLICATION
QTY REQD
DO NOT
DO
APPLY PART NO
AS SPECIFIED
MICROFILMED
DATE

FIGURE 15

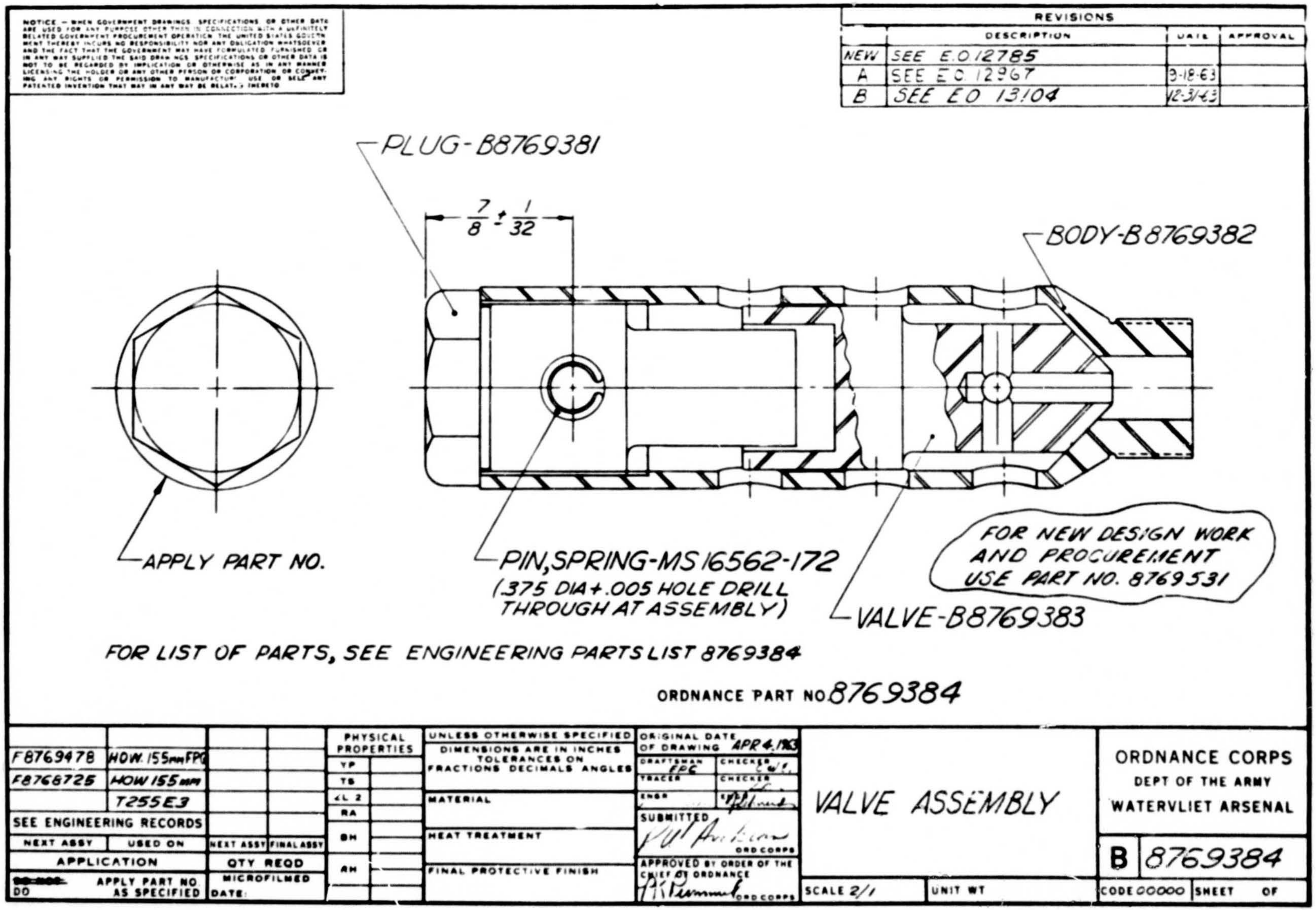

REVISIONS
DESCRIPTION
DATE
APPROVAL
NEW SEE E.O 12785
A SEE E.O 12967 9-18-63
B SEE E.O 13104 12-31-63
PLUG-B8769381
$\frac{7}{8} \pm \frac{1}{32}$
BODY-B8769382
APPLY PART NO.
PIN,SPRING-MS16562-172
(.375 DIA+.005 HOLE DRILL THROUGH AT ASSEMBLY)
VALVE-B8769383
FOR NEW DESIGN WORK AND PROCUREMENT USE PART NO. 8769531
FOR LIST OF PARTS, SEE ENGINEERING PARTS LIST 8769384
ORDNANCE PART NO 8769384
F8769478 HOW 155mm FPG
F8768725 HOW 155mm
T255E3
SEE ENGINEERING RECORDS
NEXT ASSY
USED ON
APPLICATION
NEXT ASSY
FINAL ASSY
QTY REQD
MICROFILMED
DATE
APPLY PART NO AS SPECIFIED
DO
PHYSICAL PROPERTIES
YP
TS
RA
BH
RH
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON FRACTIONS DECIMALS ANGLES
MATERIAL
HEAT TREATMENT
FINAL PROTECTIVE FINISH
ORIGINAL DATE OF DRAWING APR 4 1963
DRAFTSMAN FPC
CHECKER
TRACER
ENGR
SUBMITTED
ORD CORPS
APPROVED BY ORDER OF THE CHIEF OF ORDNANCE
VALVE ASSEMBLY
SCALE 2/1
UNIT WT
ORDNANCE CORPS
DEPT OF THE ARMY
WATERVLIET ARSENAL
B 8769384
CODE 00000
SHEET
OF

FIGURE 16

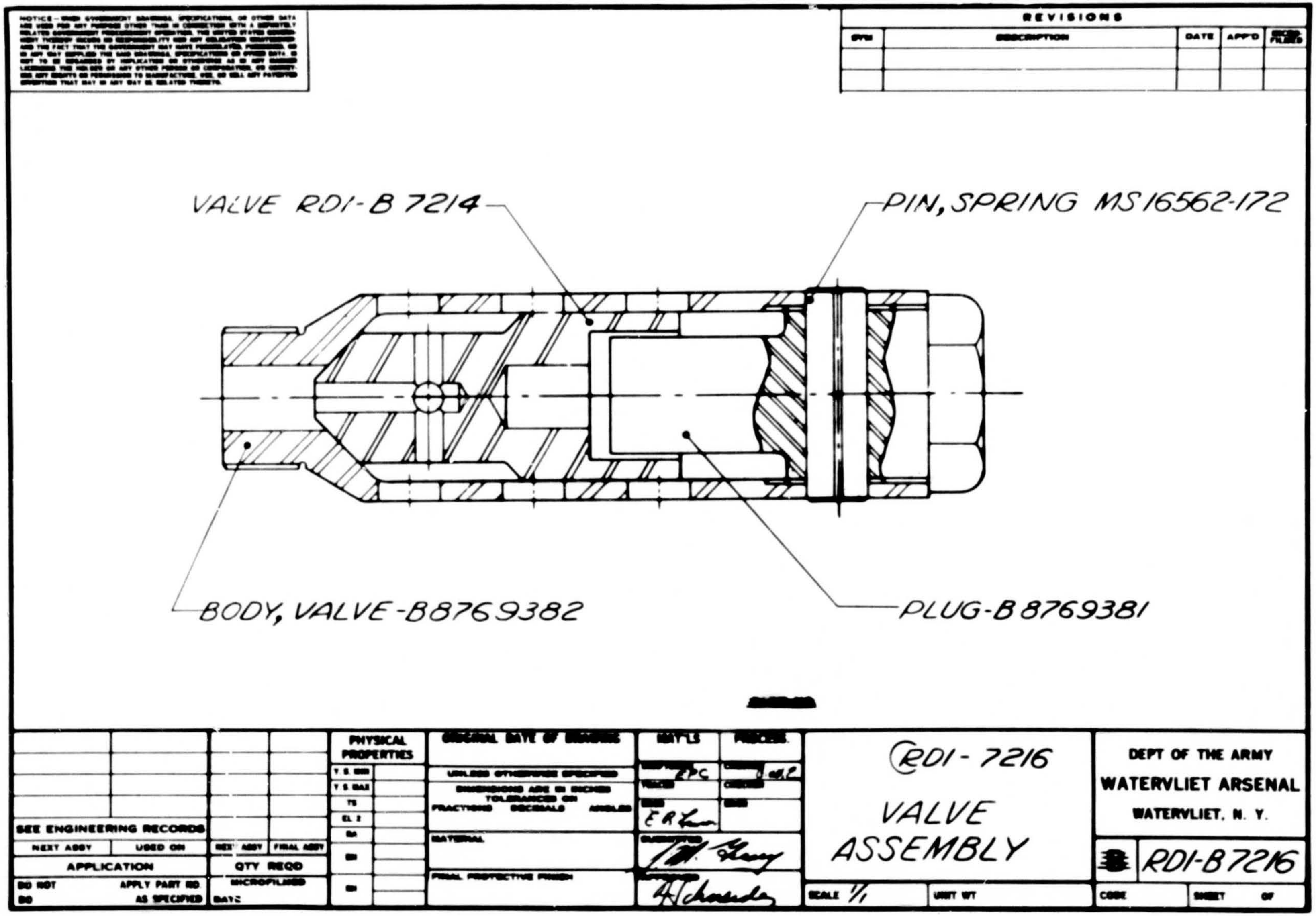

VALVE RDI-B 7214
PIN, SPRING MS16562-172
BODY, VALVE-B8769382
PLUG-B 8769381
REVISIONS
SEE ENGINEERING RECORDS
NEXT ASSY
USED ON
APPLICATION
QTY REQD
APPLY PART NO AS SPECIFIED
PHYSICAL PROPERTIES
MATERIAL
RDI - 7216
VALVE ASSEMBLY
SCALE 1/1
UNIT WT
DEPT OF THE ARMY
WATERVLIET ARSENAL
WATERVLIET, N. Y.
RDI-B7216
CODE
SHEET OF

FIGURE 17

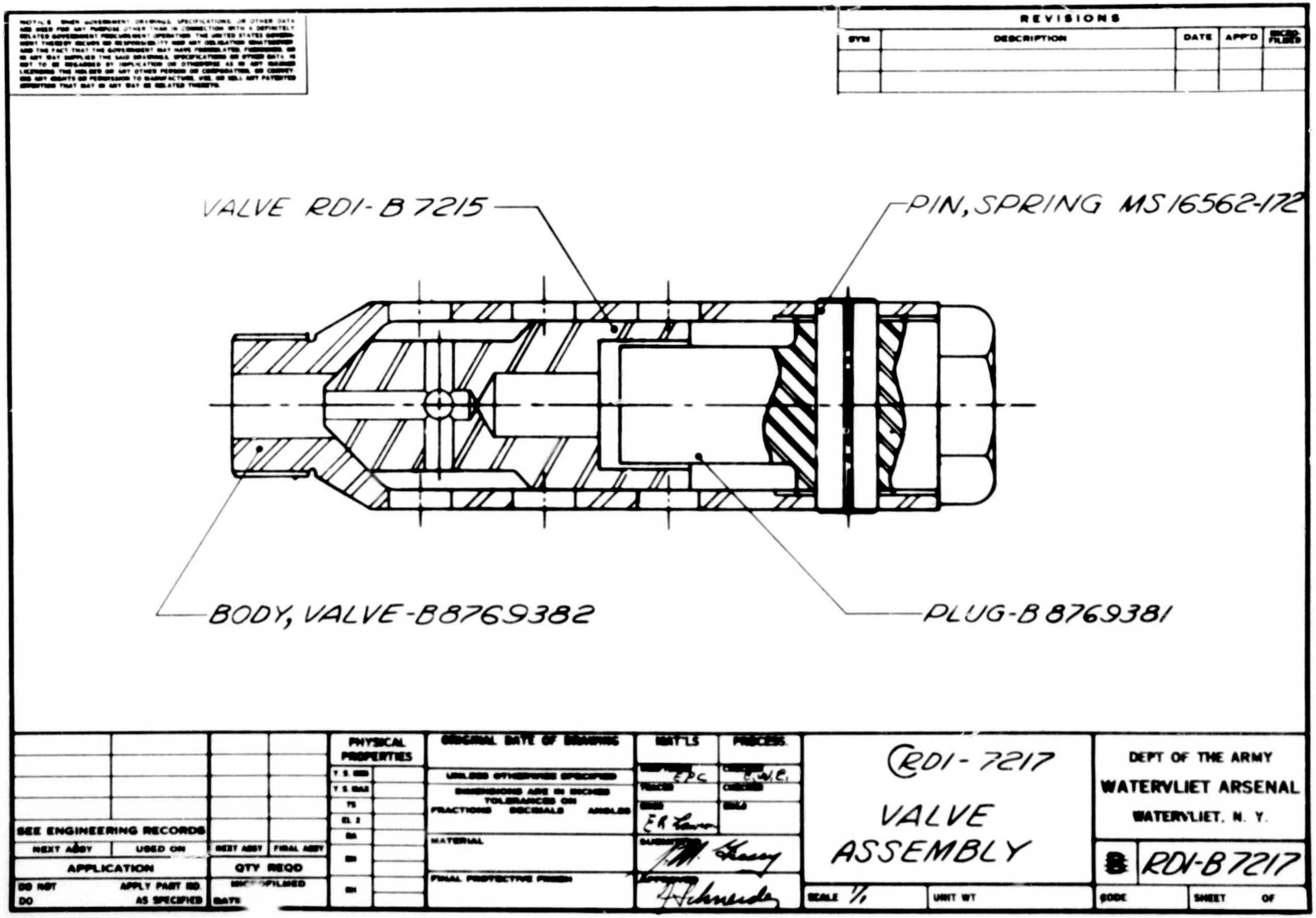
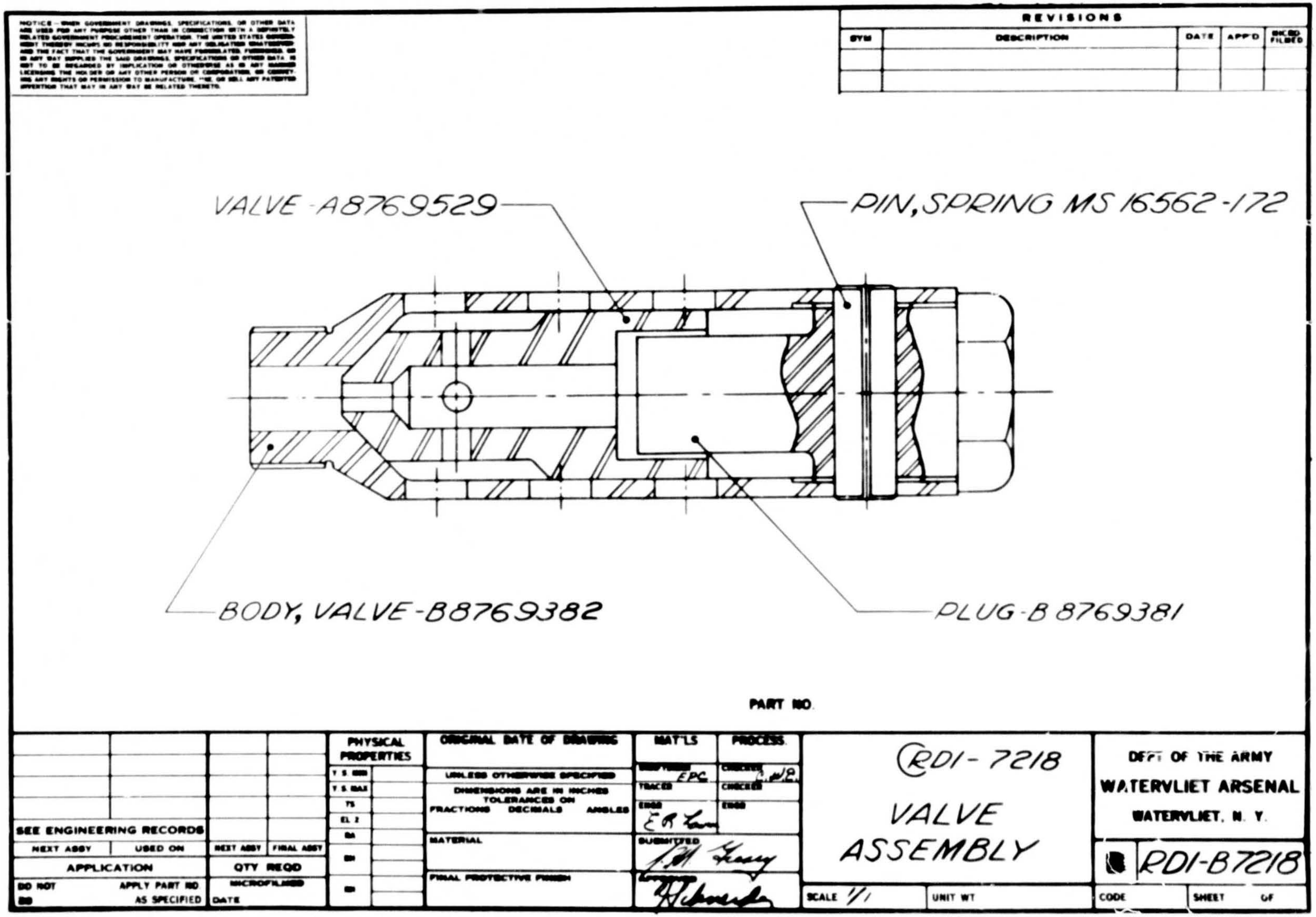

REVISIONS
SYM
DESCRIPTION
DATE
APP'D
VALVE RDI-B7215
PIN, SPRING MS16562-172
BODY, VALVE-B8769382
PLUG-B8769381
SEE ENGINEERING RECORDS
NEXT ASSY
USED ON
APPLICATION
NEXT ASSY
FINAL ASSY
QTY REQD
DO NOT
DO
APPLY PART NO.
AS SPECIFIED
PHYSICAL PROPERTIES
MATERIAL
FINAL PROTECTIVE FINISH
MAT'LS
PROCESS
EPC
E.R. Lam
RDI-7217
VALVE
ASSEMBLY
DEPT OF THE ARMY
WATERVLIET ARSENAL
WATERVLIET, N. Y.
RDI-B7217
SCALE 1/1
UNIT WT
CODE
SHEET
OF

FIGURE 18



REVISIONS
SYM
DESCRIPTION
DATE
APP'D
INC'D FILMED
VALVE-A8769529
PIN, SPRING MS 16562-172
BODY, VALVE-B8769382
PLUG-B 8769381
PART NO.
SEE ENGINEERING RECORDS
NEXT ASSY
USED ON
NEXT ASSY
FINAL ASSY
APPLICATION
QTY REQD
DO NOT
APPLY PART NO
AS SPECIFIED
MICROFILMED
DATE
PHYSICAL PROPERTIES
ORIGINAL DATE OF DRAWING
UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
FRACTIONS DECIMALS ANGLES
MATERIAL
FINAL PROTECTIVE FINISH
MAT'LS
PROCESS
EPC
TRACED
CHECKED
ENGR
SUBMITTED
RDI-7218
VALVE
ASSEMBLY
SCALE 1/1
UNIT WT
DEPT OF THE ARMY
WATERVLIET ARSENAL
WATERVLIET, N. Y.
RDI-B7218
CODE
SHEET
OF

FIGURE 19

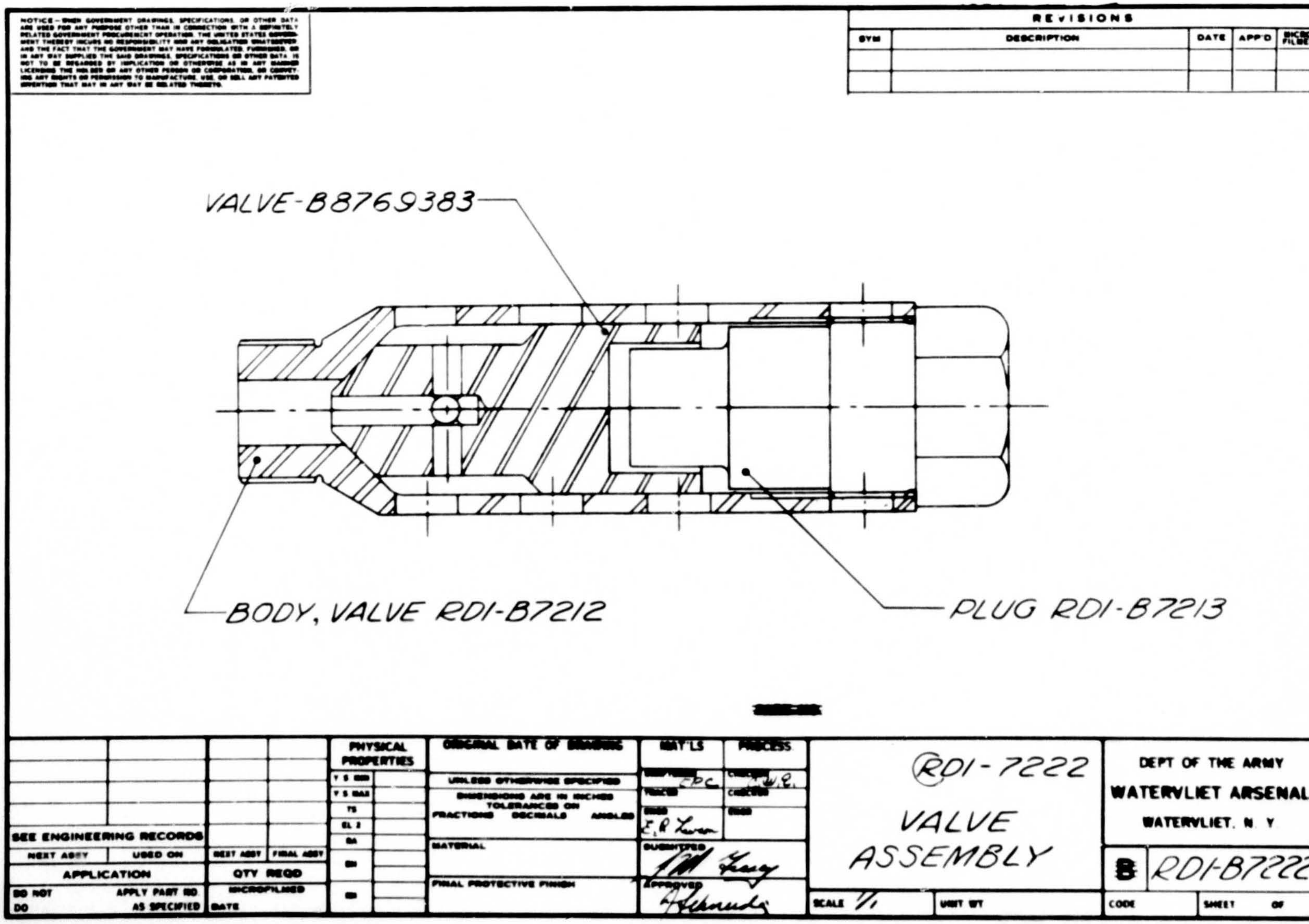
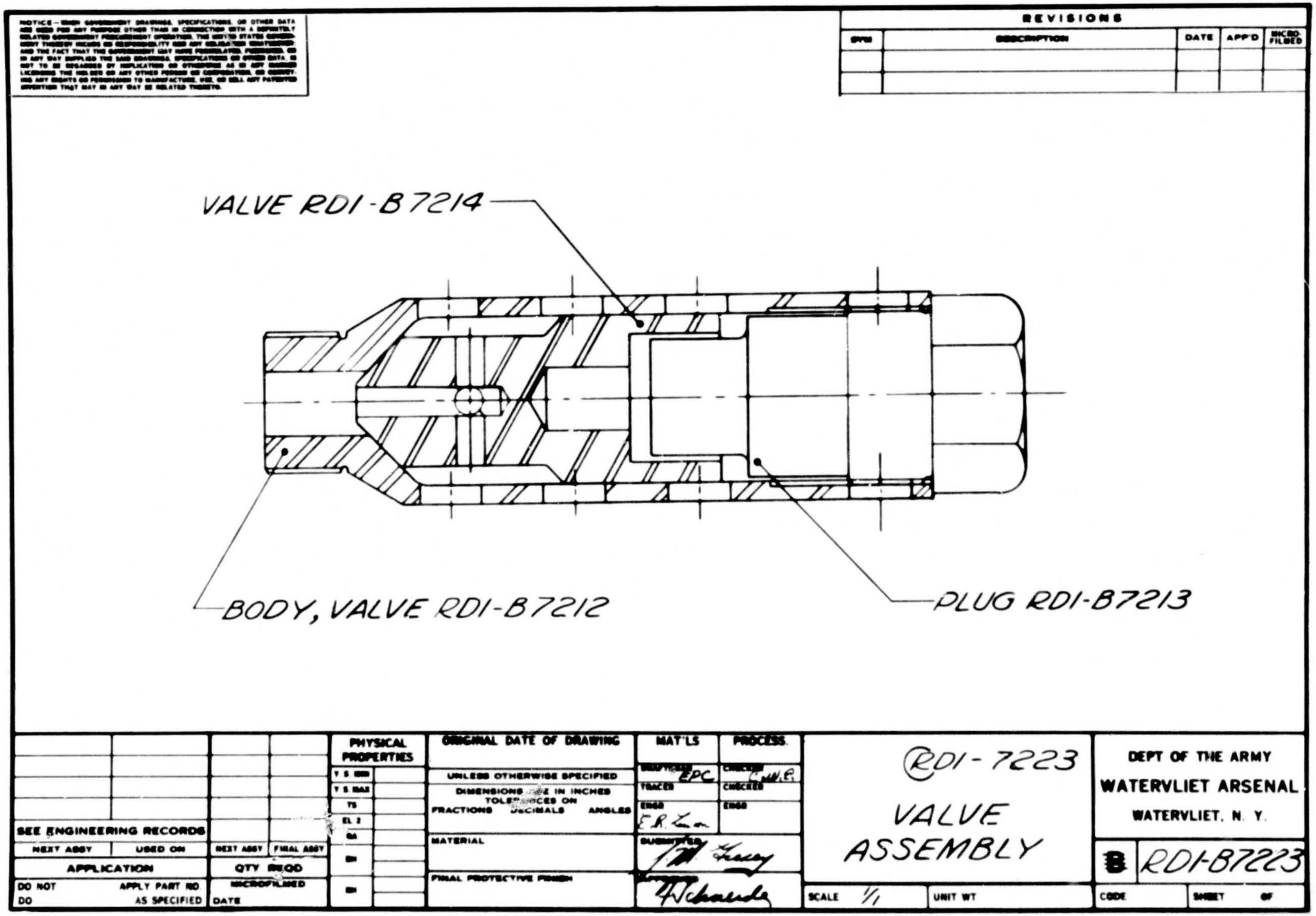

REVISIONS
SYM
DESCRIPTION
DATE
APP'D
MICRO FILMED
VALVE-B8769383
BODY, VALVE RDI-B7212
PLUG RDI-B7213
SEE ENGINEERING RECORDS
NEXT ASSY
USED ON
APPLICATION
DO NOT
DO
APPLY PART NO
AS SPECIFIED
NEXT ASSY
FINAL ASSY
QTY REQD
MICROFILMED
DATE
PHYSICAL PROPERTIES
ORIGINAL DATE OF DRAWING
UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
FRACTIONS
DECIMALS
ANGLES
MATERIAL
FINAL PROTECTIVE FINISH
MAT'LS
PROCESS
SUBMITTED
APPROVED
RDI-7222
VALVE
ASSEMBLY
SCALE 1/1
UNIT WT
DEPT OF THE ARMY
WATERVLIET ARSENAL
WATERVLIET, N. Y.
B
RDI-B7222
CODE
SHEET
OF

FIGURE 20


REVISIONS
SYM
DESCRIPTION
DATE
APP'D
MICRO-FILMED
VALVE RDI-B7214
BODY, VALVE RDI-B7212
PLUG RDI-B7213
SEE ENGINEERING RECORDS
NEXT ASSY
USED ON
NEXT ASSY
FINAL ASSY
APPLICATION
QTY REQD
DO NOT
DO
APPLY PART NO
AS SPECIFIED
MICROFILMED
DATE
PHYSICAL PROPERTIES
ORIGINAL DATE OF DRAWING
UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
FRACTIONS DECIMALS ANGLES
MATERIAL
FINAL PROTECTIVE FINISH
MAT'LS
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RDI-7223
VALVE
ASSEMBLY
SCALE 1/1
UNIT WT
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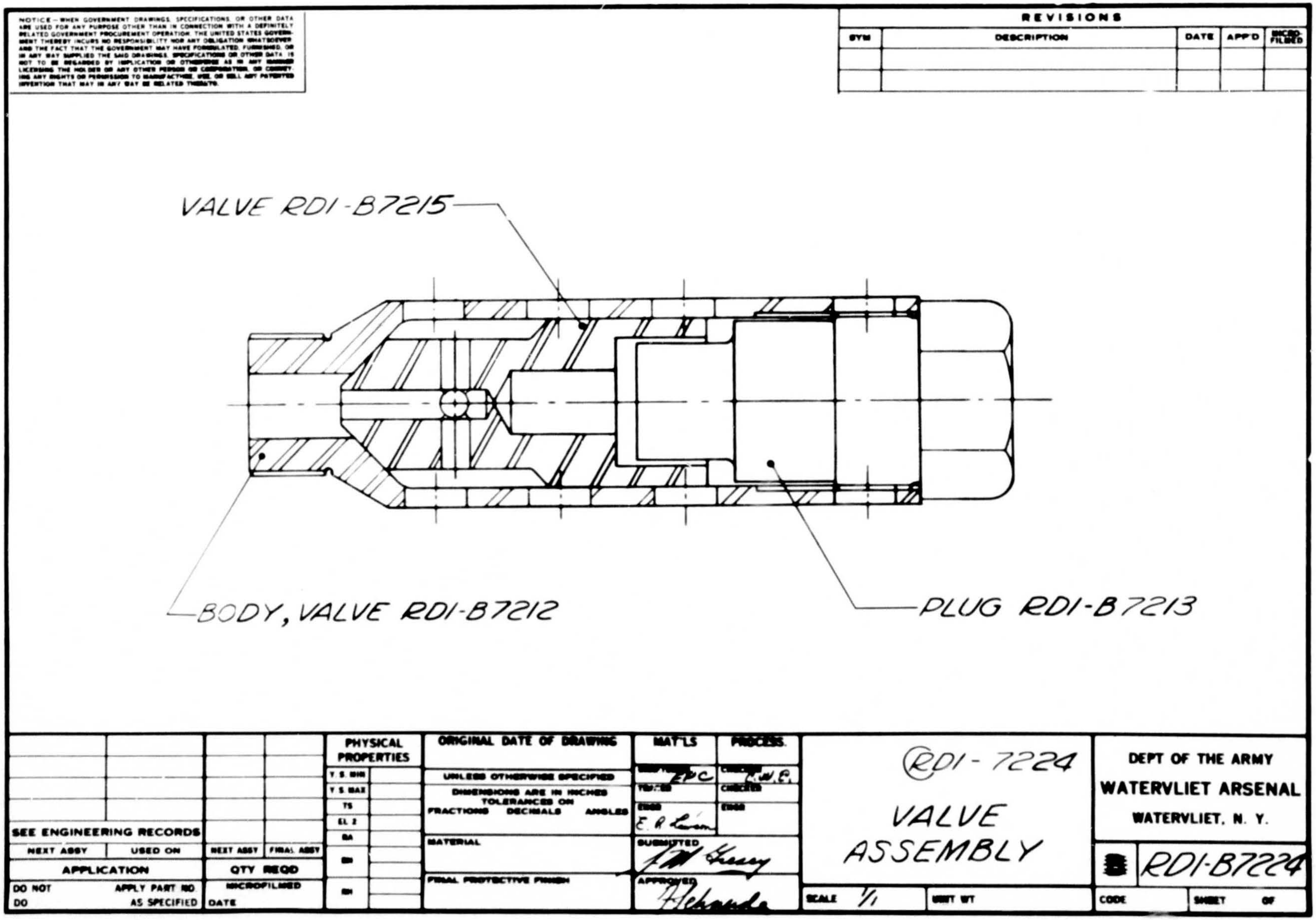
WATERVLIET ARSENAL
WATERVLIET, N. Y.
B RDI-B7223
CODE
SHEET OF

FIGURE 21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DESCRIPTION
DATE
APP'D
MICRO-FILMED
VALVE RDI-B7215
BODY, VALVE RDI-B7212
PLUG RDI-B7213
SEE ENGINEERING RECORDS
NEXT ASSY
USED ON
NEXT ASSY
FINAL ASSY
APPLICATION
QTY REQD
DO NOT
DO
APPLY PART NO.
AS SPECIFIED
MICROFILMED
DATE
PHYSICAL PROPERTIES
ORIGINAL DATE OF DRAWING
UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
FRACTIONS DECIMALS ANGLES
MATERIAL
FINAL PROTECTIVE FINISH
MAT'LS
PROCESS
SUBMITTED
APPROVED
RDI-7224
VALVE
ASSEMBLY
SCALE 1/1
UNIT WT
DEPT OF THE ARMY
WATERVLIET ARSENAL
WATERVLIET, N. Y.
RDI-B7224
CODE
SHEET OF

FIGURE 22

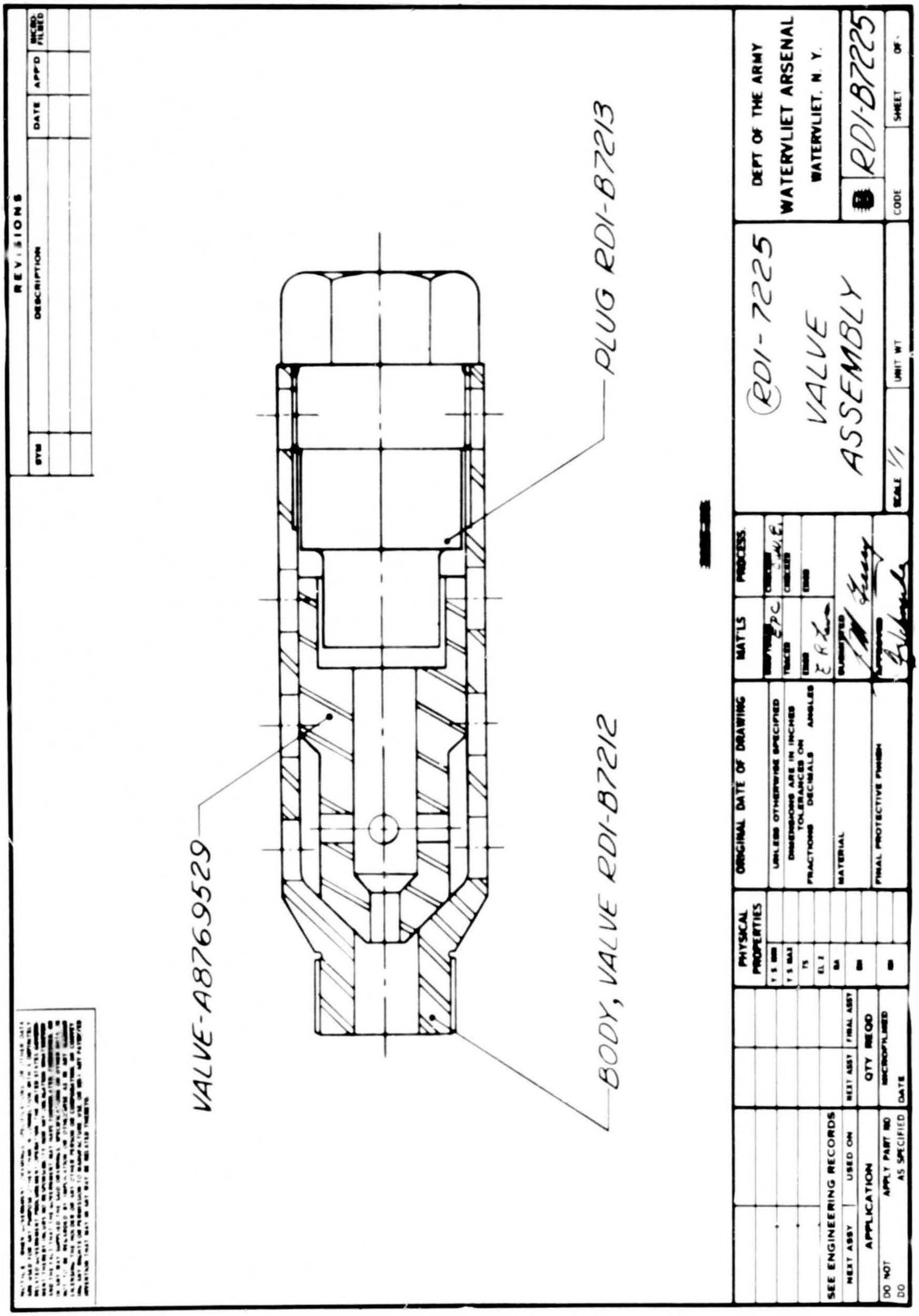

REVISIONS
VALVE-A8769529
BODY, VALVE RDI-B7212
PLUG RDI-B7213
RDI-7225
VALVE
ASSEMBLY
DEPT OF THE ARMY
WATERVLIET ARSENAL
WATERVLIET, N. Y.
RDI-B7225
SEE ENGINEERING RECORDS
APPLICATION
PHYSICAL PROPERTIES
ORIGINAL DATE OF DRAWING
MAT'LS
PROCESS
SCALE 1/1

FIGURE 23

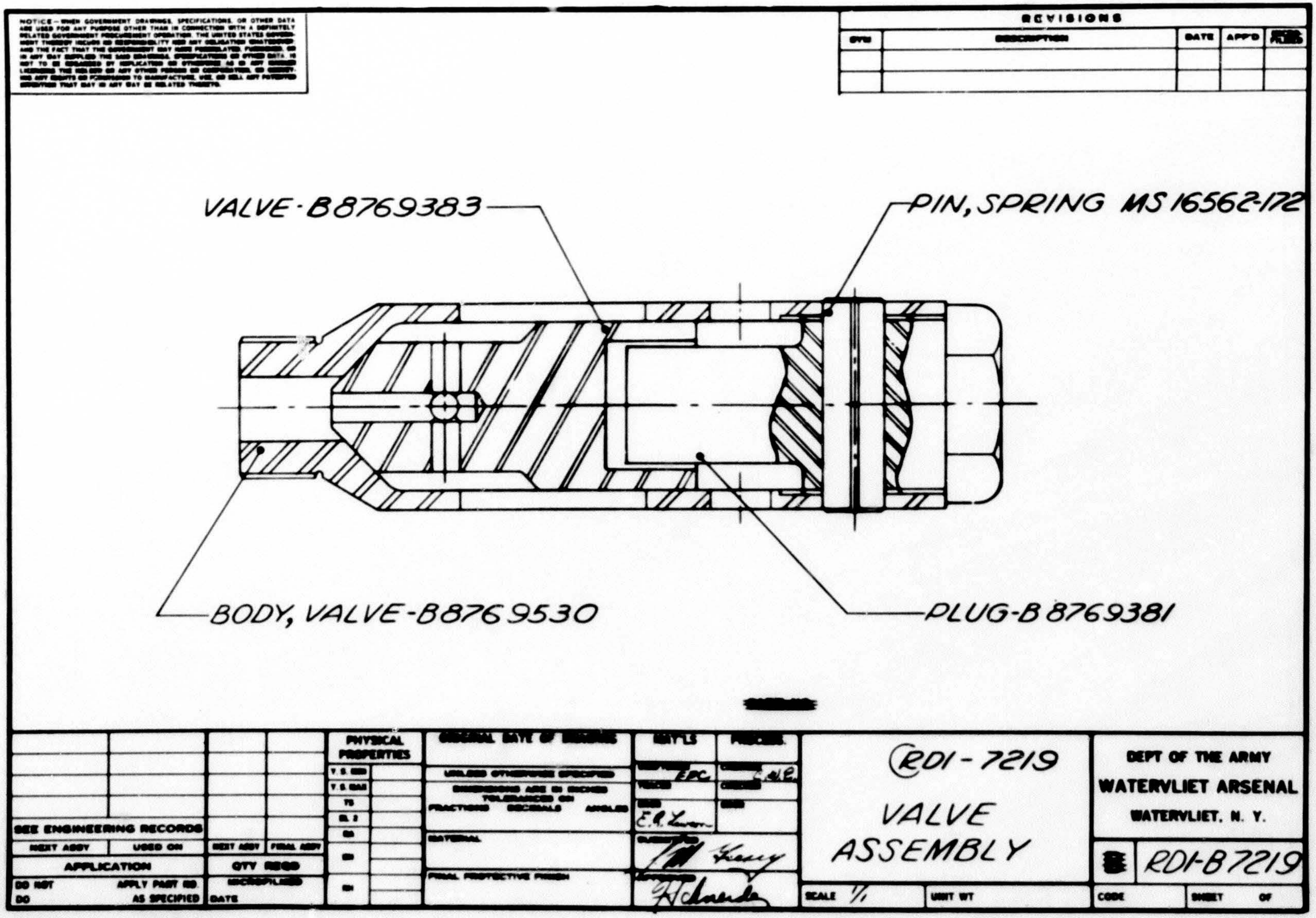

REVISIONS
DESCRIPTION
DATE
APP'D
VALVE-B8769383
PIN, SPRING MS 16562-172
BODY, VALVE-B8769530
PLUG-B8769381
PHYSICAL PROPERTIES
MATERIAL
FINAL PROTECTIVE FINISH
SEE ENGINEERING RECORDS
NEXT ASSY
USED ON
APPLICATION
QTY REQD
DO NOT
APPLY PART NO.
AS SPECIFIED
DATE
RDI - 7219
VALVE
ASSEMBLY
DEPT OF THE ARMY
WATERVLIET ARSENAL
WATERVLIET, N. Y.
RDI-B7219
SCALE 1/1
UNIT WT
CODE
SHEET OF

FIGURE 24

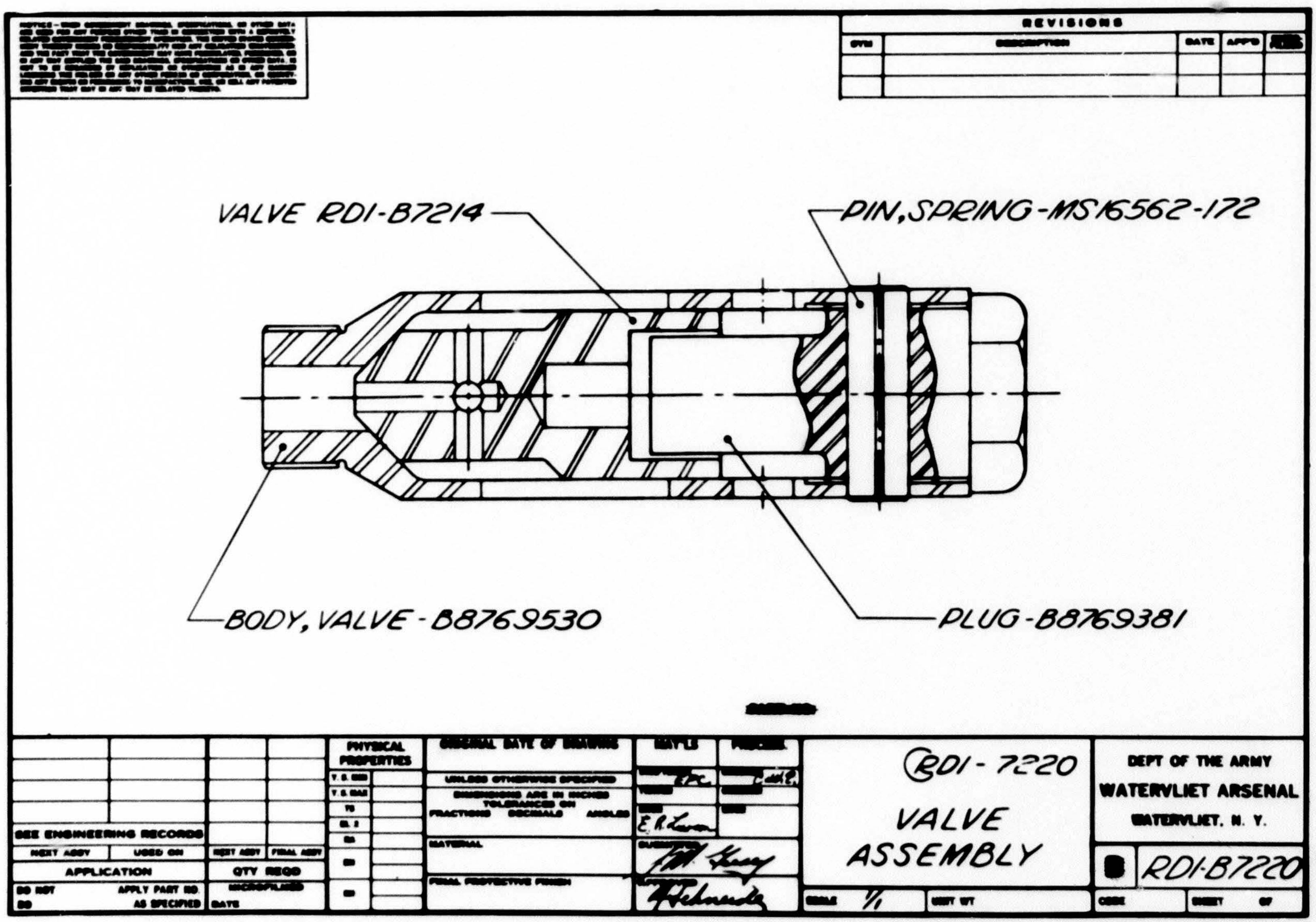
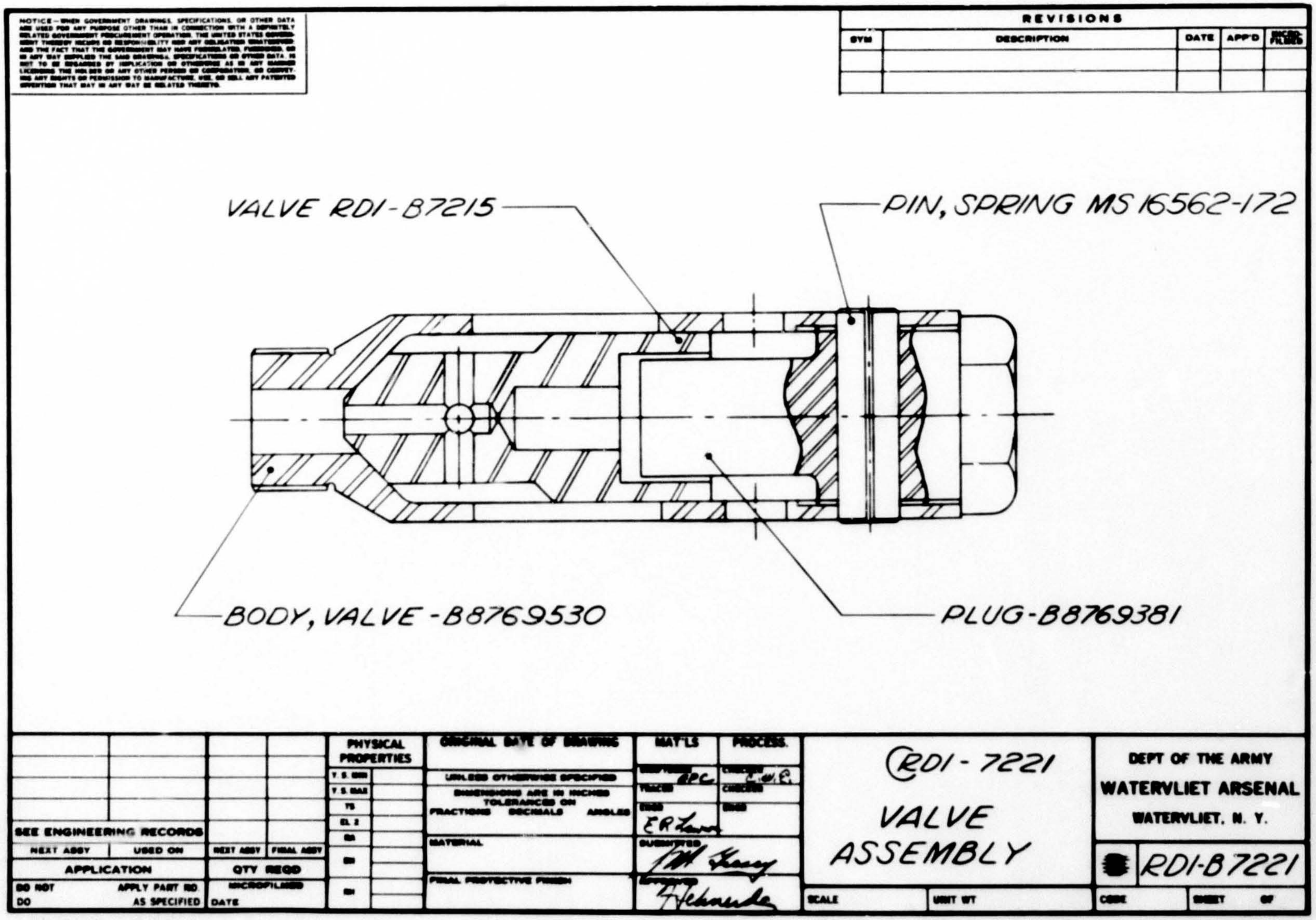

VALVE RDI-B7214
PIN, SPRING-MS16562-172
BODY, VALVE-B8769530
PLUG-B8769381
REVISIONS
RDI-7220
VALVE ASSEMBLY
DEPT OF THE ARMY
WATERVLIET ARSENAL
WATERVLIET, N. Y.
RDI-B7220
PHYSICAL PROPERTIES
ORIGINAL DATE OF DRAWING
UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
FRACTIONS DECIMALS ANGLES
MATERIAL
FINAL PROTECTIVE FINISH
SEE ENGINEERING RECORDS
NEXT ASSY
USED ON
APPLICATION
QTY REQD
APPLY PART NO. AS SPECIFIED
SCALE 1/1

FIGURE 25



VALVE RDI-B7215
PIN, SPRING MS 16562-172
BODY, VALVE-B8769530
PLUG-B8769381
REVISIONS
SYM
DESCRIPTION
DATE
APP'D
PHYSICAL PROPERTIES
ORIGINAL DATE OF DRAWING
UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
FRACTIONS DECIMALS ANGLES
MATERIAL
FINAL PROTECTIVE FINISH
MAT'LS
PROCESS
RDI-7221
VALVE ASSEMBLY
DEPT OF THE ARMY
WATERVLIET ARSENAL
WATERVLIET, N. Y.
RDI-B7221
SEE ENGINEERING RECORDS
NEXT ASSY
USED ON
NEXT ASSY
FINAL ASSY
APPLICATION
QTY REQD
DO NOT
APPLY PART NO
DO
AS SPECIFIED
DATE
SCALE
UNIT WT
CODE
SHEET
OF

FIGURE 26

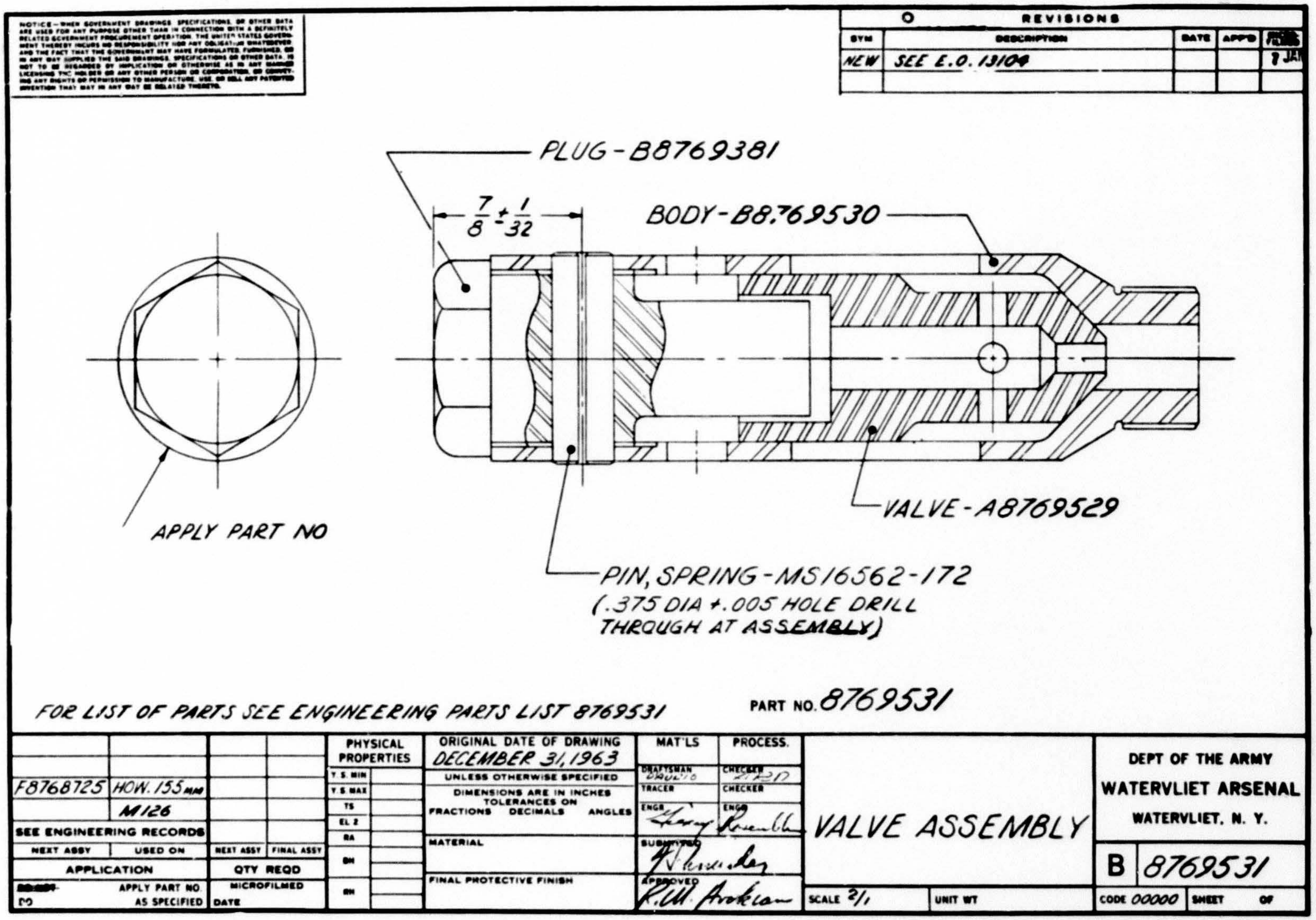

REVISIONS
NEW
SEE E.O. 13104
PLUG - B8769381
BODY - B8769530
VALVE - A8769529
APPLY PART NO
PIN, SPRING - MS16562-172
(.375 DIA +.005 HOLE DRILL
THROUGH AT ASSEMBLY)
FOR LIST OF PARTS SEE ENGINEERING PARTS LIST 8769531
PART NO. 8769531
F8768725
HOW. 155 MM
M126
SEE ENGINEERING RECORDS
NEXT ASSY
USED ON
APPLICATION
QTY REQD
APPLY PART NO. AS SPECIFIED
MICROFILMED
DATE
PHYSICAL PROPERTIES
ORIGINAL DATE OF DRAWING
DECEMBER 31, 1963
UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
FRACTIONS DECIMALS ANGLES
MATERIAL
FINAL PROTECTIVE FINISH
MAT'LS
PROCESS.
VALVE ASSEMBLY
SCALE 2/1
UNIT WT
DEPT OF THE ARMY
WATERVLIET ARSENAL
WATERVLIET, N. Y.
B 8769531
CODE 00000
SHEET OF

FIGURE 27

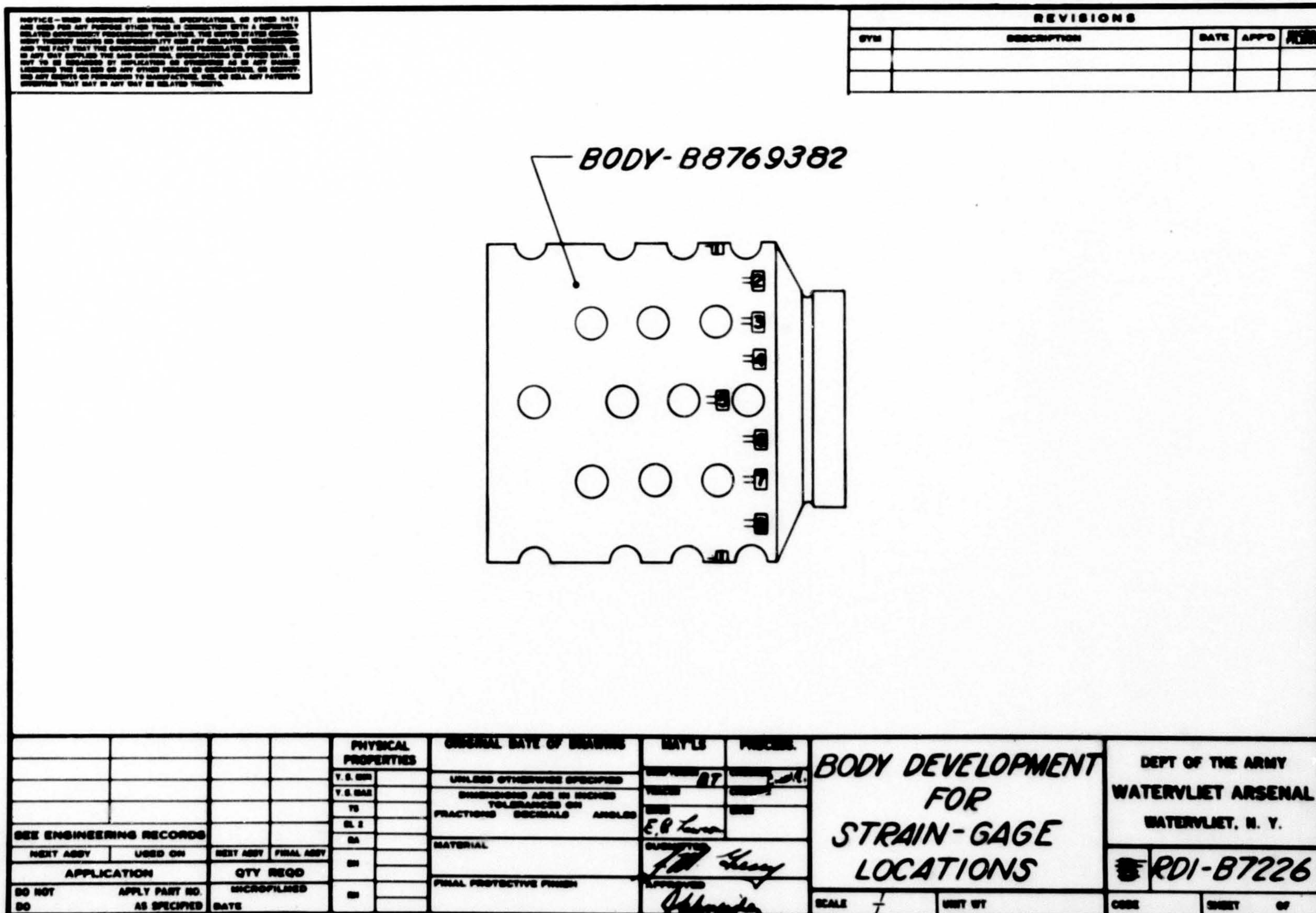

BODY-B8769382
REVISIONS
SYM
DESCRIPTION
DATE
APP'D
BODY DEVELOPMENT FOR STRAIN-GAGE LOCATIONS
DEPT OF THE ARMY
WATERVLIET ARSENAL
WATERVLIET, N. Y.
RDI-B7226
SEE ENGINEERING RECORDS
NEXT ASSY
USED ON
APPLICATION
QTY REQD
MICROFILMED
DATE
PHYSICAL PROPERTIES
UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
FRACTIONS DECIMALS ANGLES
MATERIAL
FINAL PROTECTIVE FINISH
SCALE
UNIT WT
CODE
SHEET OF

FIGURE 28

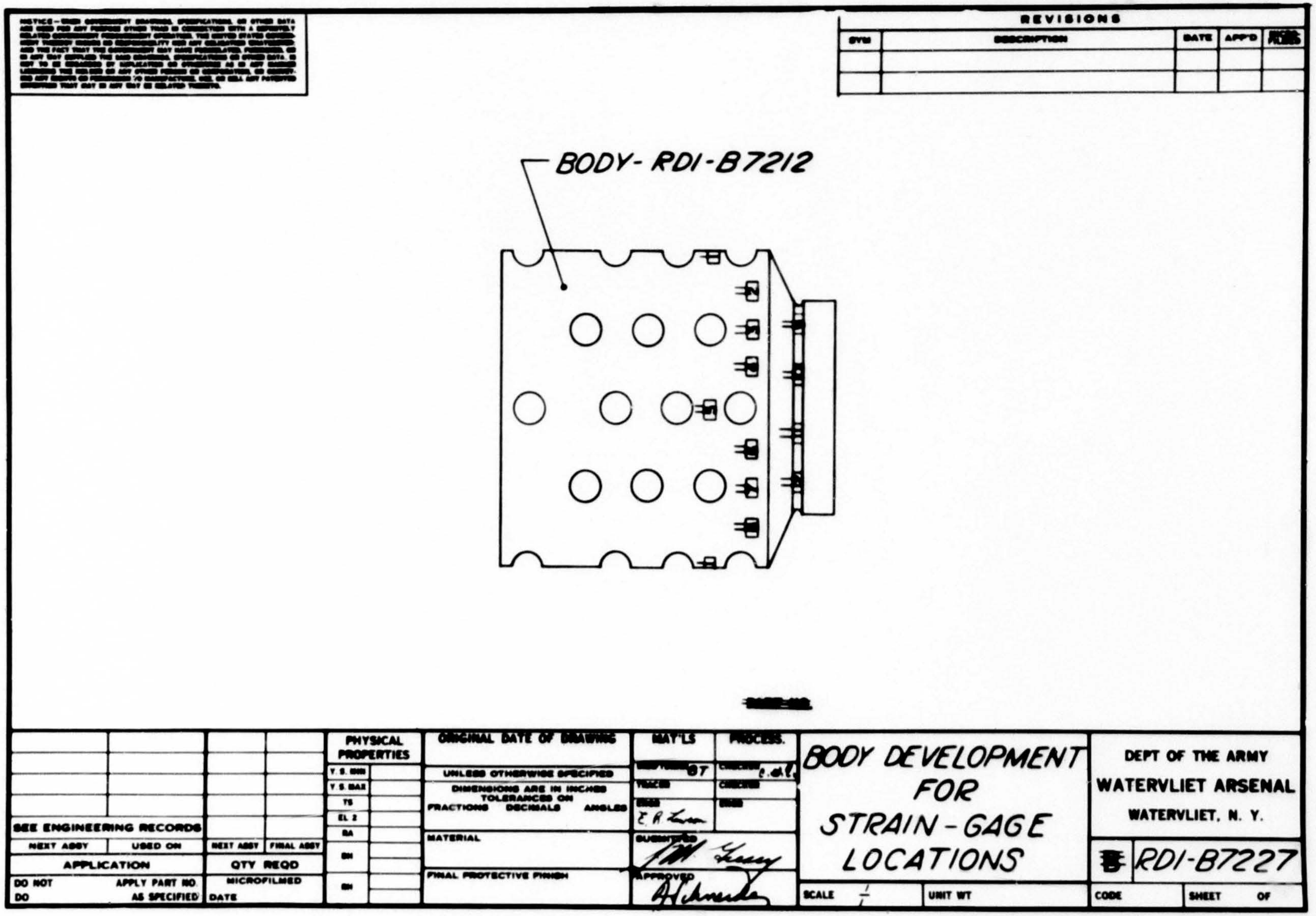

REVISIONS
SYM
DESCRIPTION
DATE
APP'D
BODY- RDI-B7212
SEE ENGINEERING RECORDS
NEXT ASSY
USED ON
NEXT ASSY
FINAL ASSY
APPLICATION
QTY REQD
DO NOT
DO
APPLY PART NO.
AS SPECIFIED
MICROFILMED
DATE
PHYSICAL PROPERTIES
ORIGINAL DATE OF DRAWING
UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
FRACTIONS DECIMALS ANGLES
MATERIAL
FINAL PROTECTIVE FINISH
MAT'LS
PROCESS.
APPROVED
BODY DEVELOPMENT
FOR
STRAIN-GAGE
LOCATIONS
SCALE
UNIT WT
DEPT OF THE ARMY
WATERVLIET ARSENAL
WATERVLIET, N. Y.
RDI-B7227
CODE
SHEET
OF

FIGURE 29

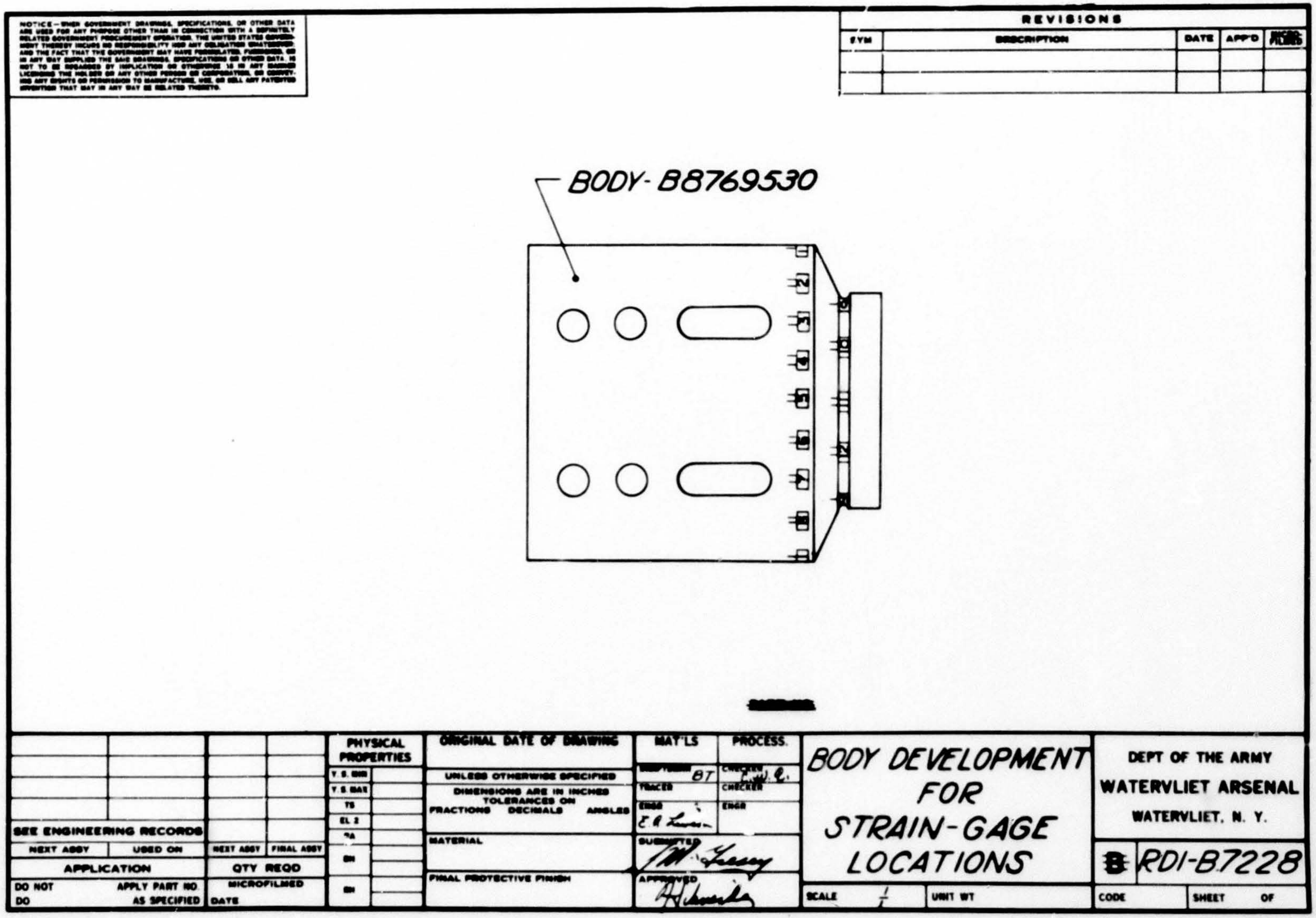
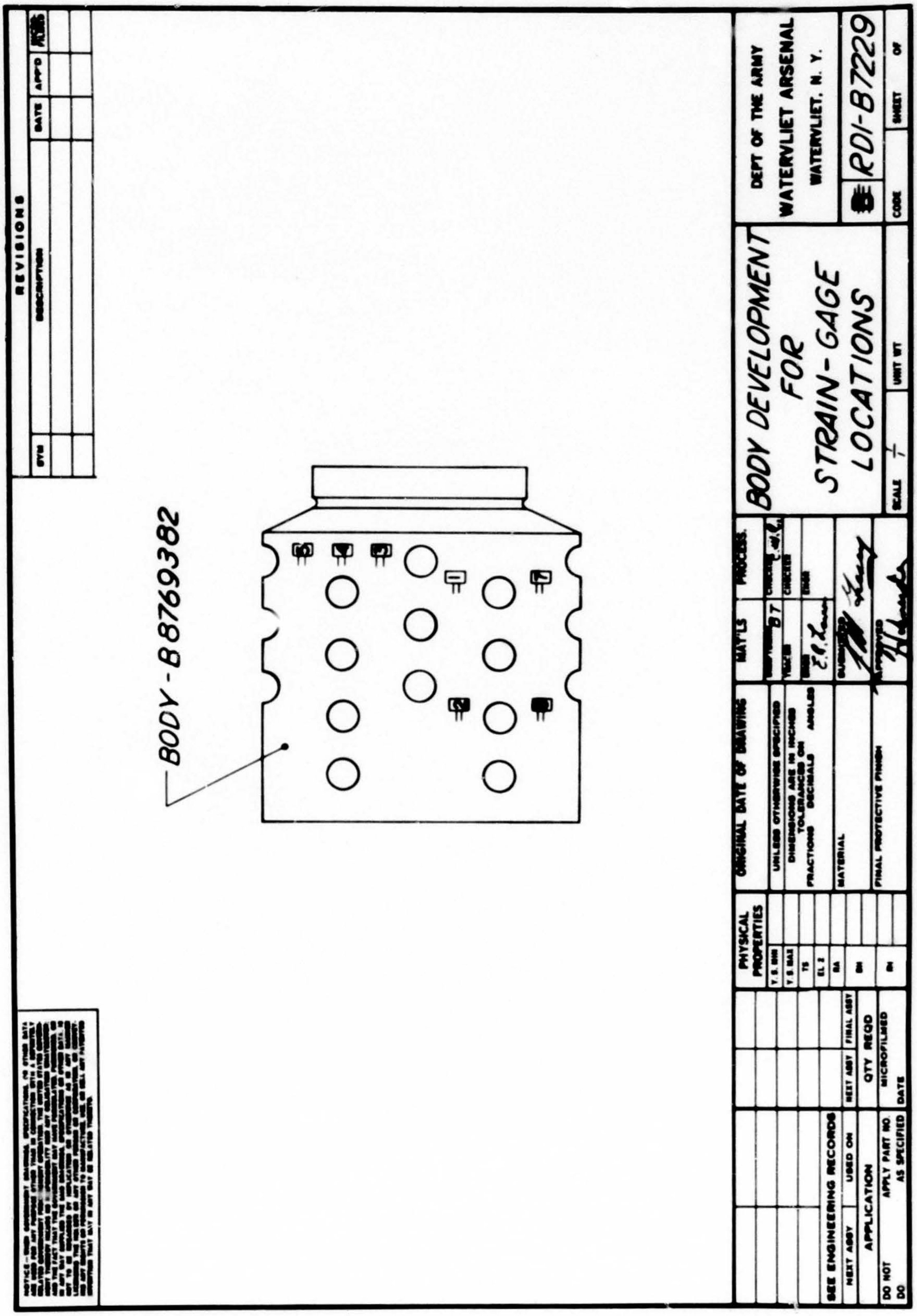

REVISIONS
SYM
DESCRIPTION
DATE
APP'D
BODY-B8769530
SEE ENGINEERING RECORDS
NEXT ASSY
USED ON
APPLICATION
DO NOT DO
APPLY PART NO. AS SPECIFIED
NEXT ASSY
FINAL ASSY
QTY REQD
MICROFILMED
DATE
PHYSICAL PROPERTIES
ORIGINAL DATE OF DRAWING
UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
FRACTIONS DECIMALS ANGLES
MATERIAL
FINAL PROTECTIVE FINISH
MAT'LS
PROCESS
BT
TRACER
CHECKER
ENGR
SUBMITTED
APPROVED
BODY DEVELOPMENT
FOR
STRAIN-GAGE
LOCATIONS
SCALE 1/1
UNIT WT
DEPT OF THE ARMY
WATERVLIET ARSENAL
WATERVLIET, N. Y.
B RDI-B7228
CODE
SHEET
OF

FIGURE 30


REVISIONS
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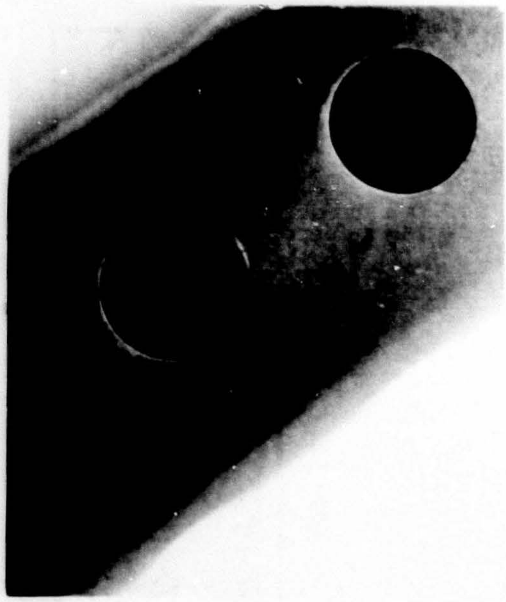
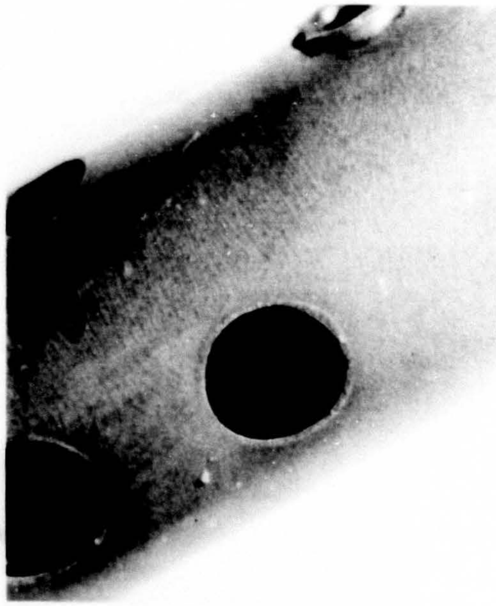
BODY DEVELOPMENT
FOR
STRAIN-GAGE
LOCATIONS
DEPT OF THE ARMY
WATERVLIET ARSENAL
WATERVLIET, N. Y.
RDI-B7229

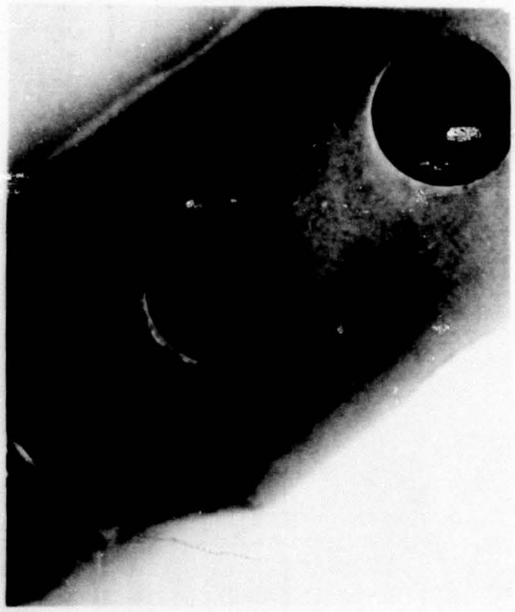
FIGURE 31



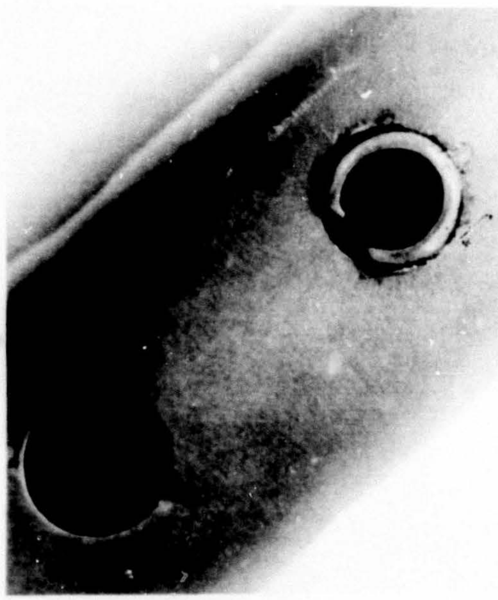
A



B



C



D

Figure 32: Four Views of the Valve Body to which "Stress Coat" had been applied.

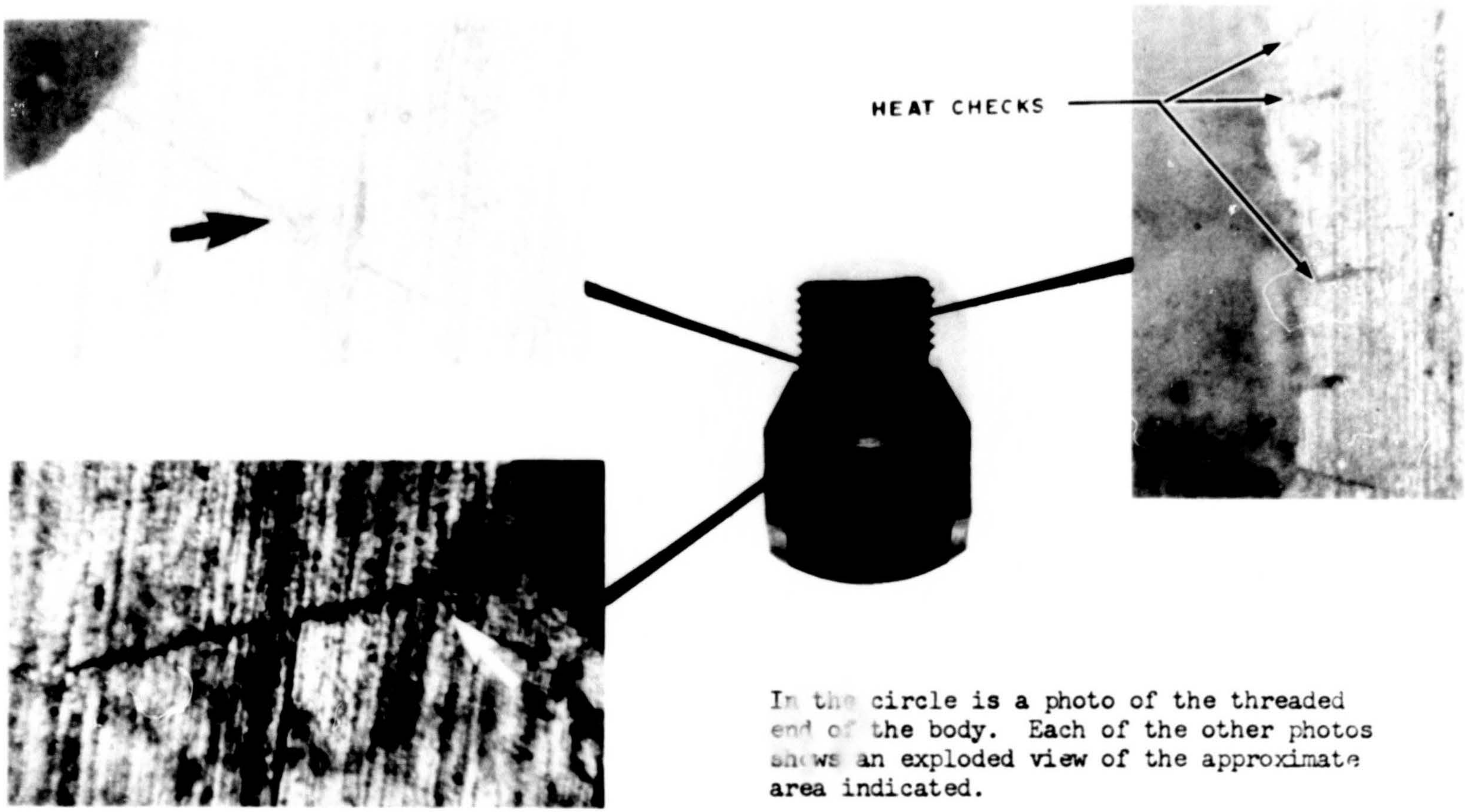
A and B are in Line.
C and D are 90° from A and B and in line.

Figure 33: View showing Magnetic Particle Indication
On S.V. 1 after 1000 rounds.

Arrow Points out Indication

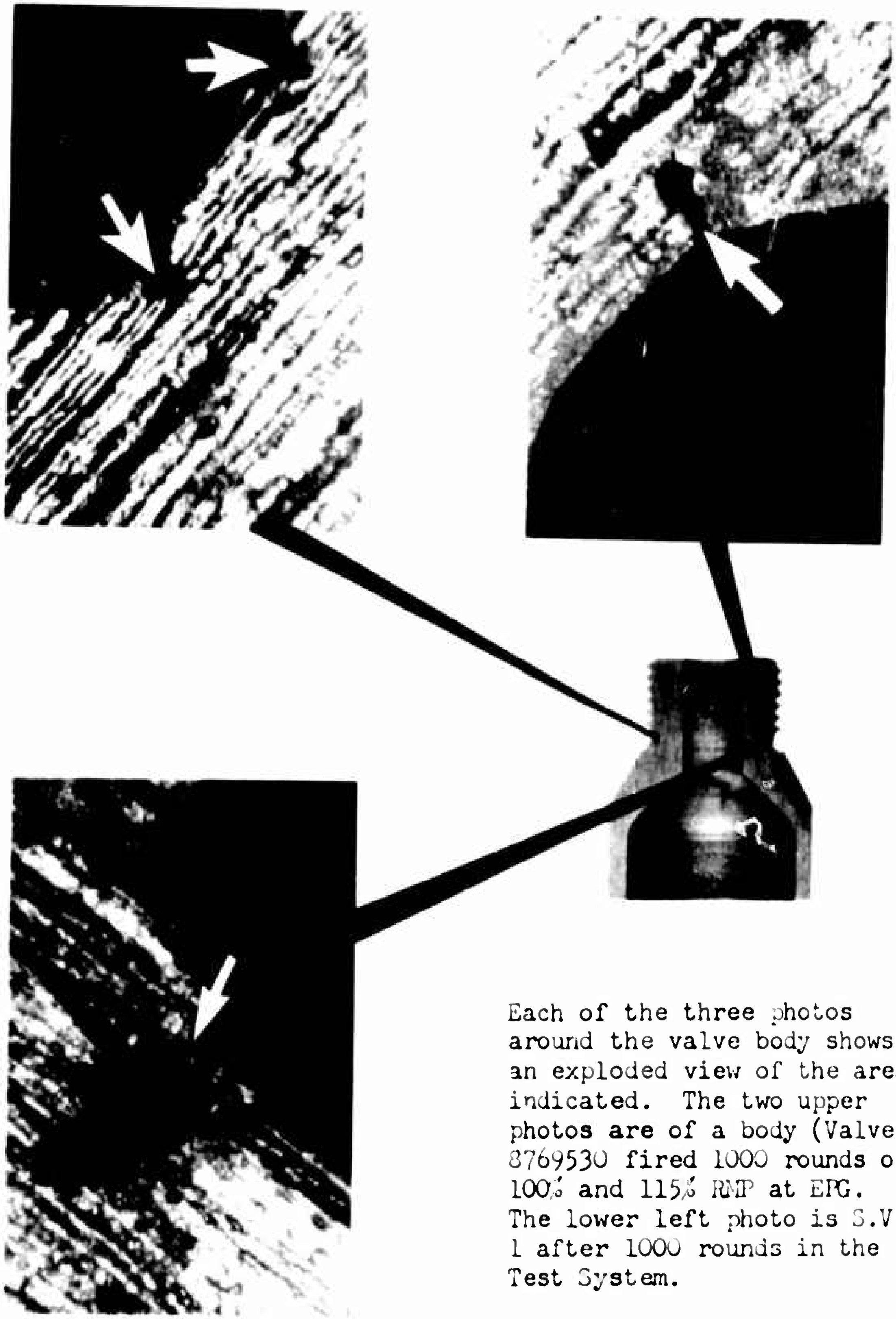
Figure 34: View showing Magnetic Particle Indication on M.V. 3 after 10,000 Rounds.

Arrow Points out Indication



In the circle is a photo of the threaded end of the body. Each of the other photos shows an exploded view of the approximate area indicated.

Figure 35: Photomacrographs of M.V. 3 after 10,000 rounds; Macroetched with 50% HCL Solution and Magnigied 65x



Each of the three photos around the valve body shows an exploded view of the area indicated. The two upper photos are of a body (Valve) 8769530 fired 1000 rounds of 100% and 115% RMP at EPG. The lower left photo is S.V. 1 after 1000 rounds in the Test System.

Figure 36: Photomacrographs Of Valve Bodies Macroetched with 50% HCL Solution and Magnified 65x

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Report No. WVT-II-6412, August 1964, 60 pages, 4 tables and 36 figures. OCMS Code No. 4020.24.2223.2.10.04 Unclassified Report

The limited life of Bore Evacuator Valve Assembly 8769384 during firing tests led to the authorization of a test program to find a valve assembly with a longer life. The cost of testing in the gun (155mm How. M126) made it economical to build a test apparatus which simulated the weapon. The test program was the basis for the incorporation of valve assembly 8769531 into the weapon system. A comparison of the strain level of the modification is presented. The life of the then current production valve assembly and the new production valve assembly under different charges is also given.

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BORE EVACUATOR VALVE TEST, CANNON 155MM HOWITZER, M126, by J. M. Giesey, Mechanical Engineer; E. R. Lawson, Mechanical Engineer and R. L. Rosenblum, Mechanical Engineer.

Report No. WVT-II-6412, August 1964, 60 pages, 4 tables and 36 figures. OCMS Code No. 4020.24.2223.2.10.04 Unclassified Report

The limited life of Bore Evacuator Valve Assembly 8769384 during firing tests led to the authorization of a test program to find a valve assembly with a longer life. The cost of testing in the gun (155mm How. M126) made it economical to build a test apparatus which simulated the weapon. The test program was the basis for the incorporation of valve assembly 8769531 into the weapon system. A comparison of the strain level of the modification is presented. The life of the then current production valve assembly and the new production valve assembly under different charges is also given.

UNCLASSIFIED

Artillery

Howitzers

Cannon, 155mm T255E3

Cannon, 155mm How. M126

Bore Evacuation

Valves

Bore Scavenging

Distribution Unlimited

AD ______ Accession No. ______

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